ANTI-ULCER DRUGS FROM INDIGENOUS SOURCES WITH EMPHASIS ON MUSA SAPIENTUM, TAMRABHASMA, ASPARAGUS RACEMOSUS AND ZINGIBER OFFICINALE

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ABSTRACT

Sula, Parinamasula and Amlapitta are clinical entities recognized by Ayurveda, akin to peptic ulcer and functional dyspepsia. Many indigenous drugs have been advocated in Ayurveda for treatment of dyspepsia. Our laboratory has been engaged in screening of various indigenous herbal and metallic drugs for their potential use in peptic ulcer diseases, taking lead from Ayurveda and have reported anti-ulcer and ulcer-healing properties of Tectona grandis (lapachol), Rhamnus procumbens (kaempferol), Rhamnus triquerta (emodin), Withania somnifera (acylsteryl glycoside), Shilajit (fulvic acid and carboxymethoxybiphenyl), Datura fastuosa (withastamin E), Fluggea microcarpa and Aegle marmelos (pyrano- and iso-coumarins) etc., along with their mechanism of action. The present article includes the detailed exploration of ulcer protective and healing effects of unripe plantain banana, tambrabhasma and Asparagus racemosus on various models of experimental gastroduodenal ulceration and patients with peptic ulcer. Their effects on mucin secretion, mucosal cell shedding, cell proliferation, anti-oxidant activity, glycoproteins, and PG synthesis have been reported. Clinical trials of these drugs for evaluating their potential ulcer healing effects in peptic ulcer patients have been done. Their potential ulcer protective effects both, experimental and clinical seemed to be due to their predominant effects on various mucosal defensive factors rather than on the offensive acid-pepsin secretion. Thus, the above herbal / herbo-mineral drugs do have potential usefulness for treatment of peptic ulcer diseases.

INTRODUCTION

Peptic ulcer therapy has undergone many strides over the past few years and a number of drugs are now available for treatment. These drugs are broadly classified into two, those that decrease or counter acid-pepsin secretion and those that afford cytoprotection by virtue of their effects on mucosal defensive factors. These drugs act by different mechanisms. Most of the commonly used drugs such as H₂- blockers (ranitidine, famotidine etc), M₁ blockers (pirenzepine, telenzepine etc), proton pump inhibitors (omeprazole, lansaprazole etc), decrease secretion of acid while, drugs like sucralfate and carbenoxolone promote mucosal defenses. Of late the role of these drugs on the defensive factors is gaining importance. It is now assumed that these drugs ultimately balance the aggressive factors (acid, pepsin, H. pylori, bile salts) and defensive factors (mucin secretion, cellular mucus, bicarbonate secretion, mucosal blood flow and cell turnover). Although these drugs have brought about remarkable changes in ulcer therapy, the efficacy of these drugs is still debatable. Reports on clinical evaluation of these drugs show that there are incidences of relapses and adverse effects and danger of drug interactions during ulcer therapy. Hence, the search for an ideal anti-ulcer drug continues and has also been extended to herbal drugs in search for new and novel molecules, which afford better protection and decrease the incidence of relapse.
In Ayurveda, peptic ulcer mostly refers to Amlapitta or Parinamasula. Amlapitta is a disease of the gastrointestinal tract, especially of the stomach. It has not been described as an independent disease in major Ayurvedic texts, but has been mentioned in short in *Kashyapa samhita*. Amlapitta literally means, pitta leading to sour taste. Apart from the stress laid on food habits and personal hygiene, some herbal drugs have also been mentioned. Modern medicine has not adequately evaluated the usefulness of these drugs in ulcer therapy, although studies have been reported. Some active constituents have also been isolated from these potential anti-ulcerogenic plant drugs (Table 1 and 2).

An attempt has been made to summarize some of the important anti-ulcer studies done with herbal plants in our laboratory and elsewhere during the last few decades to highlight the developments made and also to provide clues and avenues for future research. A detailed review would be practically difficult due to enormity of information available. Thus, this presentation reviews in detail some plant products like unripe plantain banana (*Musa sapientum* var. *paradisiaca*), Tamrabhasma (an indigenous preparation of copper), ginger (*Zingiber officinale*) and satavari (*Asparagus racemosus*) and gives an overview on other potential anti-ulcerogenic drugs.

**Musa sapientum var. paradisiaca** (unripe plantain banana)

Extensive investigations regarding anti-ulcerogenic and ulcer healing activities of plantain banana have been carried out in our laboratory for the past 30 years. Sanyal *et al*., have reported the anti-ulcerogenic activity of dried powder of banana pulp (DRBP) against ulcers induced by histamine in guinea pigs and, phenylbutazone, restraint stress and prednisolone in rats. Other workers like Elliott and Heward and Best, *et al*., have also confirmed the anti-ulcerogenic activity of banana against histamine-induced gastric ulcers in mice and aspirin-induced gastric ulcers in rats respectively. In a comprehensive study done with DRBP and its various extracts against various experimental gastro-duodenal ulcers and radiologically proved cases of peptic ulcers, DRBP showed its usefulness as mentioned in Ayurveda. The study further proved that the anti-ulcer effect of banana in 4 hr pylorus-ligation (PL) rats was not due to its 5-HT content as presumed earlier, but could be due to its predominant effect on mucosal defensive factors. The effect of biological variables like size, season and soil on the anti-ulcerogenic activity of DRBP has been evaluated and it was reported that the activity was primarily observed with unripe, mature, green plantain banana obtained from *Musa sapientum* Linn. *Var. paradisiaca* collected between the months of September to March along the Gangetic belt in the northern parts of the Indian sub-continent. Activity was lost due to ripening or drying of pulp at temperature above 60°C and absent in the small sized fruits. Less or no activity was found in the banana collected from the southern states during the same period. DRBP was reported to have no activity on offensive acid pepsin secretion and the effect was mostly ascribed to increase in gastric mucus secretion quantified in terms of total carbohydrate:protein ratio (TC:P ratio). Further studies with DRBP on the changes induced by ulcerogenic agents like aspirin (ASP), phenylbutazone, indomethacin and prednisolone in the dissolved mucosubstances of gastric juice showed that it not only increased the TC:P ratio of the gastric juice, but also reversed the decrease in ratio induced by ulcerogenic drugs. While, there was no change in the individual carbohydrates significant decrease in protein content of the gastric juice was observed leading to increase in TC:P ratio. Decrease in protein content signifies decreased leakage from gastric mucosa indicating increased strengthening of gastric mucosal barrier. Increase in glycoprotein content of the mucosa and cell shedding in the gastric juice were also reported as further evidence for strengthening of mucosal resistance. Apart from mucosal resistance DRBP was also reported to increase cell proliferation as observed from increase in DNA and [3H]-thymidine uptake by the mucosal cells and increase in mucosal thickness. This property was also reported to be involved in healing of ulcers.

Ethanolic extract of banana (BE) was reported to increase the accumulation of eicosanoids like prostaglandins E and I₂ (PGE and PGI₂) and leukotrienes
<table>
<thead>
<tr>
<th>Plants</th>
<th>Extracts</th>
<th>Models</th>
<th>Mode of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Tectona grandis L.</td>
<td>Ethanolic fraction</td>
<td>PL-, RS- and prednisolone-induced GU in rats. HIST- induced GU and DU in GP</td>
<td>No effect on acid-pepsin secretion but caused an increase in mucin secretion.</td>
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<tr>
<td>(Trunk Bark and wood chips)</td>
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<tr>
<td>2. Withania somnifera</td>
<td>SG-1 [total methanol - H&lt;sub&gt;2&lt;/sub&gt;O (1:1)]</td>
<td>RS- induced GU in rats</td>
<td>Anti-stress activity</td>
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<tr>
<td>(Roots)</td>
<td>SG-2 (sitoindosides VII, VIII and withaferin-A)</td>
<td></td>
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<tr>
<td>3. Shilajit</td>
<td>per se effect</td>
<td>PL-, IS- and ASP- induced GU in rats and CYS-and HIST- induced DU in rats and GP respectively</td>
<td>Tendency to decrease acid-pepsin secretion and significant increase in mucin secretion</td>
</tr>
<tr>
<td>4. Wedelia calendulacea</td>
<td>Aqueous and ethanolic extracts</td>
<td>ASP- and RS-induced (antiulcer) and acetic acid (healing)-induced GU in rats</td>
<td>-</td>
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<tr>
<td>(Leaves)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>5. Pongamia pinnata</td>
<td>PE, AE, CE and EE extracts</td>
<td>RS- induced GU in mice</td>
<td>-</td>
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<tr>
<td>(seeds)</td>
<td></td>
<td>RS- and PL- induced GU in rats</td>
<td>Decrease in acid-pepsin and increase in mucin secretion by ethanolic extract</td>
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<tr>
<td>(Roots)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Abies pindrow Royle</td>
<td>CE, AE and EE extracts</td>
<td>CRS- induced GU in rats</td>
<td>Antistress activity</td>
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<tr>
<td>(Leaves)</td>
<td></td>
<td></td>
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<tr>
<td>7. Sitavirya drugs</td>
<td>Fresh juice</td>
<td>PL- and CRS- induced GU in rats</td>
<td>No effect on acid-pepsin secretion and promotes mucosal defensive factors by enhancing mucin secretion and life span of mucosal cells</td>
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<tr>
<td>a. Asparagus acemosus</td>
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<td>PL- and CRS- induced GU in rats</td>
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<tr>
<td>(Roots)</td>
<td></td>
<td>PL- and CRS- induced GU in rats</td>
<td></td>
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<tr>
<td>b. Glycyrrhiza glabra</td>
<td>Water decoction</td>
<td>PL- and CRS- induced GU in rats</td>
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<tr>
<td>(Roots)</td>
<td></td>
<td>PL- and CRS- induced GU, CYS-induced DU in rats</td>
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<tr>
<td>c. Holarrhene antidysenterica</td>
<td>Water decoction</td>
<td>PL- and CRS- induced GU</td>
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<td>Wall. (Barks)</td>
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<td>PL- and CRS- induced GU and CYS-induced DU in rats</td>
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<tr>
<td>d. Ficus religiosa</td>
<td>Water decoction</td>
<td>PL- and CRS- induced GU</td>
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<tr>
<td>(Barks)</td>
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<td>PL- and CRS- induced GU and CYS-induced DU in rats</td>
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<tr>
<td>8. Bacopa monniera</td>
<td>Fresh juice</td>
<td>CRS-, ethanol-, ASP- and PL-induced GU in rats</td>
<td>No effect on acid-pepsin secretion, increase in mucin secretion and life span of mucosal cells</td>
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<tr>
<td>(Whole plant)</td>
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<tr>
<td>9. Convolvulus pluricaulis</td>
<td>Fresh juice</td>
<td>CRS-, ethanol-, ASP- and PL-induced GU in rats</td>
<td>No effect on acid-pepsin secretion, increase in mucin secretion and life span of mucosal cells</td>
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<tr>
<td>(Whole plant)</td>
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<tr>
<td>10. Centella asiatica</td>
<td>Fresh juice</td>
<td>CRS-, ethanol-, ASP- and PL-induced GU in rats</td>
<td>No effect on acid-pepsin secretion, increase in mucin secretion and life span of mucosal cells</td>
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<tr>
<td>(Whole plant)</td>
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<td>Plants</td>
<td>Extracts</td>
<td>Models</td>
<td>Mode of action</td>
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<td>11. <em>Emblica officinalis</em> (Fruits)(^67,68)</td>
<td>Fresh juice</td>
<td>CRS-, ethanol, ASP- and PL-induced GU in rats</td>
<td>No effect on acid-pepsin secretion, increase in mucin secretion and life span of mucosal cells.</td>
</tr>
<tr>
<td>12. <em>Selaginella bryopteris</em>(^69)</td>
<td>Ethanolic extract</td>
<td>RS ulcers in rats</td>
<td></td>
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<tr>
<td>13. <em>Camellia sinensis</em>(^70)</td>
<td>Hot water extract</td>
<td>Cold + Restraint stress induced ulcers in rats</td>
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<td>14. <em>Cissampelos mononata</em>(^71) (Leaf)</td>
<td>Methanolic extract</td>
<td>Indomethacin-, HIST-, stress-induced GU</td>
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<tr>
<td>15. <em>Ginkgo biloba</em>(^72)</td>
<td>Ethanolic extract</td>
<td>Ethanol induced GU</td>
<td></td>
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<tr>
<td>16. <em>Vitex negundo</em>(^73)</td>
<td>Aq. extract</td>
<td>Piroxicam-induced GU</td>
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</tbody>
</table>

AE-Acetone; ASP-Aspirin; CE-Chloroform; CRS-Cold restraint stress; CYS-Cysteamine; DU-Duodenal ulcer; EE-Ethanolic; GP-Guinea pig; GU-Gastric ulcer; HIST-Histamine; PE-Petroleum ether; PL-Pylorus ligation; RS-Restraint stress

\(B_4, C_4, D_4, \text{LTB}_4, C_4', D_4'\) in the human gastric and colonic mucosal incubates. PGs are reported to be one of the factors involved in the anti-ulcerogenic activity, while LTs caused it. Water extract of banana was comparatively ineffective.\(^14\) The effect of banana on \(\text{LTC}_4/D_4\) explains its ineffectiveness against ethanol-induced gastric ulcers as leukotrienes are reported to be one of the important causes of ulceration induced by ethanol (EtOH).\(^15\)

Best, et al.\(^8\), reported that the anti-ulcerogenic and ulcer healing effect of DRBP against aspirin induced gastric ulcers in rats was due to its ability to stimulate the growth of gastric mucosa and the active constituents were thermolabile, water soluble and insoluble in organic solvents.\(^8\) They also reported the absence of anti-secretory effects and that even though DRBP contains high amount of 5-HT the activity was not due to it.\(^15\)

Ghosal and coworkers have isolated and characterized many active principles from vegetable banana. They have reported anti-ulcerogenic activity of sterylacylglycosides, sitoindosides I-IV isolated from *Musa paradisiaca* Linn. against ulcers in rats and humans.\(^16-18\) Sitoindoside IV was also reported to significantly mobilize and activate peritoneal macrophages with increase in DNA and \(^3\)H-thymidine uptake in different organs indicating possible role of macrophages in aiding wound healing, which may account for its anti-ulcer activity.\(^19\) Lewis, et al had reported the antiulcer activity of a flavanoid, leucocyanidin isolated from unripe plantain banana pulp.\(^20\) Recently the methanolic extract of banana was reported to have anti-oxidant effect but not anti-\(H.pylori\) activity in vitro.\(^21\)

The clinical usefulness of DRBP was substantiated using radiological and endoscopic studies. It was found to decrease or delay the relapse of peptic ulcer to 6-12 months after 3 months continuous treatment with banana powder, when given in the dose of 1 g q.i.d. It was available as Musapep after Phase IV clinical trials. Double blind study done at many centers have shown that about 40-70% of endoscopically proved duodenal ulcers healed after 12 weeks of treatment with DRBP, as compared to about 16% with placebo.\(^9\)

In another clinical study with Musapep in non-ulcer dyspepsia (NUD), Arora and Sharma have reported relief in symptoms by 75% after 8 weeks of treatment compared to only 20% in the controls.\(^22\) They advocated that the therapeutic trials with this dose justified the use of DRBP on clinical grounds to be safe and effective in the treatment of NUD.
## Table 2. Ulcer protective effect of some active constituents isolated from herbal drugs.

<table>
<thead>
<tr>
<th>Plants</th>
<th>Active constituents</th>
<th>Models</th>
<th>Mode of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <em>Tectona grandis</em> Linn. (Trunk bark and wood chips)*74</td>
<td>Lapachol</td>
<td>IS- and ASP- induced GU in rats. CYS- and HIST-induced DU in rats and GP respectively.</td>
<td><em>per se</em> no significant effect on both offensive and defensive factors, but reversed the ASP-induced increase in peptic activity and decrease in sialic acid and mucin secretion.</td>
</tr>
<tr>
<td>2. <em>Rhamnus procumbens</em> (Whole plant)*75,76</td>
<td>Kaempferol</td>
<td>PL-, ethanol, IS- and CRS- induced GU in rats and HIST- induced GU and DU in GP.</td>
<td>Decrease in acid-pepsin secretion and increase in mucin secretion. Endogenous increase in PGs and decrease in LTs₄.</td>
</tr>
<tr>
<td>3. <em>Shilajit</em></td>
<td>Fulvic acid, 4/-methoxy 6-carbomethoxy bi phenyl</td>
<td>PL-, PL+ASP- and RS- induced GU and CYS- induced DU in rats.</td>
<td><em>per se</em> decrease in acid-pepsin secretion and cell shedding, tendency to increase mucin secretion, but reversed the increase in cell shedding and decrease in mucin secretion induced by ASP.</td>
</tr>
<tr>
<td>4. <em>Rhamnus triquerta</em> Wall (Whole plant)*78</td>
<td>Emodin</td>
<td>RS-, PL- and IS- induced GU in rats</td>
<td>Decrease in acid-pepsin secretion and increase in mucin secretion in ASP- treated group.</td>
</tr>
<tr>
<td>5. <em>Datura fastuosa</em> (Leaves)*79,80</td>
<td>Withastusonin- E</td>
<td>CRS-, PL- and ASP- induced GU in rats</td>
<td><em>per se</em> decrease in acid-pepsin and no effects on mucin secretion, mucosal cell shedding, proliferation and glycoproteins. Significant increase in endogenous PGs.</td>
</tr>
<tr>
<td>6. <em>Flueggea microcarpa</em> (Leaves and roots)*81</td>
<td>Bergenin/ norbergenin</td>
<td>PL- and ASP- induced GU in rats and CRS- induced GU in rats and GP.</td>
<td>Increase in endogenous PGs</td>
</tr>
<tr>
<td>7. <em>Aegle marmelos Correa</em> (Seeds)*81</td>
<td>Luvangetin</td>
<td>-do-</td>
<td></td>
</tr>
<tr>
<td>8. <em>Azadirachta indica</em> 82</td>
<td>Nimbidin</td>
<td>ASP-, prednisolone-, indomethacin-, serotonin stress- and acetic acid-induced GU in rats. HIST- induced DU in GP. CYS- induced DU in rats</td>
<td></td>
</tr>
<tr>
<td>9. <em>Picrasma quassioides</em>83</td>
<td>MeOH extract, CHCl₃ soluble fraction, Nigakilactone and Methynigakinone</td>
<td>ASP- induced GU in rats</td>
<td></td>
</tr>
<tr>
<td>10. <em>Ocimum basilum</em> *84</td>
<td>Fixed oil</td>
<td>ASP-, indomethacin-, ethanol, HIST-, reserpine-, Serotonin-, PL- and stress-induced GU in rats</td>
<td>Antisecretory</td>
</tr>
<tr>
<td>11. <em>Bacopa monniera</em> (Whole plant)*85</td>
<td>Standardized extract of bacoside A (35%)</td>
<td>CRS-, ethanol, ASP- and PL- induced GU in rats</td>
<td>No effect on acid-pepsin secretion, increase in mucin secretion and life span of mucosal cells.</td>
</tr>
</tbody>
</table>

AE-Acetone; ASP-Aspirin; CE-Chloroform; CRS-Cold restraint stress; CYS-Cysteamine; DU-Duodenal ulcer; EE-Ethanolic; GP-Guinea pig; GU-Gastric ulcer; HIST-Histamine; IS-Immobilization stress; PE-Petroleum ether; PL-Pylorus ligation; RS-Restraint stress;
The results of the above studies with dried plantain banana pulp powder, therefore makes it a potent herbal drug for the treatment of peptic ulcer disease and prompts that chemistry of banana pulp should be studied extensively to find out the active principle(s), which can be promising ulcer healing drug/s. Till then one should not hesitate to use its dried powder in the treatment of peptic ulcer disease as the powder seemed to be safe and potent, and only a self-limiting diarrhea was reported as an adverse effect.

**Tamrabhasma**

Use of herbo-mineral preparations in Ayurveda is well documented. Tamrabhasma (TMB), a traditional preparation of copper has been suggested for its use in *Amlapitta* 23. An earlier published study has given the composition of TMB as: CuO ≥ 44.45 % ≤ 66.13%; Fe₂O₃ < 6.03 % & S < 2.75%. Extensive studies have been undertaken to unravel the anti-ulcerogenic activity of TMB. TMB has shown to possess ulcer protective activity against various gastric ulcers induced by 8 h - immobilization stress (IS), 4h PL and aspirin in rats and histamine- induced gastric and duodenal ulcers in guinea pigs. The activity was due to both, decrease in offensive acid-pepsin and increase in defensive mucin secretion. Further evaluation of TMB from different sources compared to pure compound and mixture of major ingredients of TMB for anti-ulcerogenic activity, revealed that TMB preparation was better than pure copper compound or a mixture of known ingredients. Quantitative differences in TMB preparation also showed the importance of pharmaceutical processing in the therapeutic activity of TMB. TMB has an overall solubility in water of approximately 1 % and 12 ng/ml CuO forms a saturated solution at 50°C, implying that, when used orally it would have local effect than being systemically absorbed. This reduces the possibility of systemic toxicity with copper. Toxicity studies have shown that TMB was safe and even 1000 times of the effective antiulcer dose was tolerable in rats.

TMB was also found to have anti-ulcerogenic effect against aspirin-induced ulcers without affecting the anti-inflammatory activity of aspirin. TMB seemed to have prolonged effect as the protective effect of TMB lasted up to 5 days after discontinuation of treatment. So aspirin - copper combination may reduce ulcerogenic activity of aspirin without affecting its anti-inflammatory effect. Goel and Maiti, have reported the gastric protective effect of TMB against CRS-induced gastric ulcers in rats and guinea pigs and its healing effect against acetic acid- induced gastric ulcers in rats18. TMB was reported to increase PGE₂ and decrease LTC₄ in human gastric and colonic mucosal incubates. The mucosal protective effects of TMB and CuCl₂ could be due to their effect on endogenous PGs and LTs. TMB showed better and potent effect compared to CuCl₂ on PGs release both in gastric and colonic incubates suggesting that other ingredients of TMB add on to its effects. TMB significantly protected rats against ethanol-induced ulcers and the effect was ascribed to decrease in LTC₄/D₄ synthesis.

TMB has also been reported to increase the defensive mucopolysaccharides including sialomucin and fucose, decrease DNA in gastric juice suggesting decrease in cell shedding and increase in life span of mucosal cells, with no change in mucosal DNA and incorporation of [H]-thymidine uptake in mucosal tissues, indicating absence of activity on cell proliferation.

Thus, the effect of TMB on offensive acid-pepsin secretion and leukotrienes, and defensive mucus secretion, mucosal glycoproteins, prostaglandin and cell shedding may contribute to its ulcer protective activity.

**Asparagus racemosus** (Hindi-Satavari)

*Asparagus racemosus* (AR) is commonly mentioned as a rasayana in the Ayurveda. Rasayanas are those plant drugs, which promote general well being of an individual. They are considered to prevent aging, increase longevity and offer resistance to diseases by augmenting the immune system. AR is one of the *sitavirya* drugs and has been cited in treatment of peptic ulcer diseases by Chakradutta, a connotation on *Caraka samhita* and Susrutha Samhita. *Sitavirya* property is usually present in *madura* (sweet), tikta (bitter) and kasaya (astringent). Rasa containing drugs usually purifies the pitta (*Astanga Hridaya, Susrasthana*, 16/11). The anti-ulcerogenic activity of juice of fresh roots of AR has been reported against cold-restraint stress- and pylorus ligation-induced gastric ulcers. The activity was reported to be due to both decrease in
offensive acid-pepsin secretion and increase in defensive mucin secretion. Mucin secretion was quantified in terms of TC:P ratio in the gastric juice. The strengthening of the mucin barrier further led to a decrease in DNA content of the gastric juice indicating decrease in cell shedding. In continuation of earlier experimental work, a Satavari containing Ayurvedic preparation, Satavari mandur (SM) has undergone clinical trails and has shown promising results. It has been observed that SM, when given in the dose of 1.5 g, twice daily for a month not only produced significant improvement in symptoms of peptic ulcer, but also healed endoscopically proved cases of ulcer dyspepsia by 75%. The biochemical estimations of offensive acid-pepsin and defensive mucin secretion and cell shedding (μg DNA/ml) before and after treatment with SM showed a tendency to decrease acid-pepsin secretion, significant decrease in cell shedding and increase in mucin secretion indicating its predominant effect on mucosal defensive factors.

**Zingiber officinale Roscoe**

Ginger consist of the near surface and underground rhizomes of *Z. officinale*. Ginger has been used as a condiment and medicine for centuries. Its use is recorded in early Sanskrit and Chinese texts and is also documented in ancient Greek, Roman and Arabic medical literature. Numerous uses of ginger are reported. Powdered rhizome of ginger root has been used as a traditional remedy for gastrointestinal complaints including in treating peptic ulceration despite the fact that ginger promotes gastric secretions.

Water decoction of ginger making up one of the constituents of *Mahakasyaya drugs* along with water decoction of *Piper longum* and colloidal solution of *Ferula asafoetida* has been reported to protect against CRS-, ASP- and PL- induced gastric ulcers in rats. Although increase in offensive acid-pepsin secretion was observed in this study, the increase in defensive mucin secretion was sufficient enough to protect against experimental ulcers.

Gingerols have been reported to be responsible for the characteristic taste and many pharmacological activities including motion. It was speculated that the anti motion sickness properties of ginger resulted from effects on the central nervous system. Studies show that ginger increases gastrointestinal propulsion. Several anti-ulcer compounds have been isolated from ginger, including 6-gingesulphonic acid, 6-shogaol and ar-curcumene. Most notable is 6-gingesulphonic acid, which showed weaker pungency and more potent anti-ulcer activity than 6-gingerol and 6-shogaol. The antilulcer activity of ginger may also be due to the potent thromboxane synthetase inhibition. High doses of ginger probably act as a gastric irritant. Fresh ginger in quantities of 6 g or more caused a significant increase in exfoliation of gastric surface epithelial cells in human volunteers. Ginger was shown to significantly scavenge superoxide and hydroxyl radicals and inhibit lipid peroxidation.

**MISCELLANEOUS PLANTS/NATURAL AGENTS**

Various other herbal drugs have been reported to posses anti-ulcerogenic activity. These are summarized in Table 1. Some of these drugs have been chemically characterized and the entities involved in the activity have been isolated. These are summarized in Table 2.

Mild irritants are known to protect the gastric mucosa from ulcerogens by adaptive cytoprotection. In a conclusive study, it was reported that hypertonic saline (5 % NaCl) significantly provided protection in ASP-, CRS-, EtOH- and PL-induced gastric ulcers by reducing offensive acid-pepsin secretion and increasing defensive factors like mucin secretion and mucosal endogenous PGs.

**CONCLUSION**

Ulcers were previously thought to be due to increase in offensive factors namely acid and pepsin, but it has been found that acid secretion is either normal or below normal in gastric ulcer patients, and that 40 - 70 % cases of duodenal ulcer patients show acidity within normal range, suggesting that other factors are also involved in ulcerogenesis. Hence the interest then shifted to the defensive factors, whose imbalance with the offensive factors are now thought to be the cause of ulcers. Most of the anti-secretory drugs reduce acid secretion, thus giving immediate symptomatic relief, but there are reports of adverse effects and relapses in the long run. On the contrary natural drugs mostly augment the defensive factors.
and may be slow in activity but are reliable and safe. Hence use of natural drugs alone or with combination with other drugs should be seriously considered.

With emphasis on quality and also our market going global, it becomes a necessity to isolate, identify, characterize and standardize the active constituents from herbal sources. Standardization is indispensable to maintain reproducible quality in biological evaluation. With more information being available on gastro-duodenal ulcerations, consideration of these modern aspects in evaluation of herbal drugs becomes important. Hence the blend of Ayurvedic knowledge supported by modern science is necessary to do a comprehensive study.

It is apparent that experimental evaluation of herbal drugs for the treatment of gastric ulcer is rather impressive, but very few have reached clinical trials and still few have been marketed. This shows that the benefits of research are not reaching the people to whom medical research is directed and hence the time, manpower and resources are not efficiently utilized.

Hence, pharmacologists need to take more active interest in evaluation of herbal drugs for potential antiulcer activity and standardization of such herbal drugs to be clinically effective and globally competitive.

REFERENCES

23. Bhavaprakash Nighantu of Shri Bhava Misra (1500-1600).


46. Yamahara J, Huang Q, Li Y, Xu L, Fujimura H. Gastrointes-
tinal motility enhancing effect of ginger and its active con-


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**ESSENTIAL OILS FOUND TO FIGHT BACTERIA**

A pair of orthopaedic surgeons report that two essential oils--eucalyptus and tea-tree oil--are surprisingly effective at treating methicillin-resistant Staphylococcus aureus (MRSA) infections.

Dr. Eugene Sherry of the University of Sydney in Australia said that, applied to the skin of infected wounds an antibacterial wash derived from *Eucalyptus radiata* and *Melaleuca alternifolia*--better known as eucalyptus and tea-tree oil--can work when modern antibiotics fail.

He said that he used the combination "once a day for several months" in a series of 25 patients with MRSA. "Twenty-two of the infections resolved completely," Sherry reported. In 19 patients, the infections resolved without the use of antibiotics, while three patients required antibiotic treatment, he said. In addition, 10 of the patients were diabetic, which "makes healing of wounds very difficult," Sherry said in an interview.

Two years ago, Sherry attended a presentation about the antibacterial properties of essential oils and decided to research the subject. He said that he discovered a wealth of 50-year-old research concerning essential oils, but said "all that research was abandoned when modern science discovered antibiotics."

When Sherry decided to initiate a trial of eucalyptus and tea-tree oil in MRSA patients, he discovered that Dr. Patrick H. Warnke, an orthopedic surgeon at the University of Kiel in Germany, was pursuing a parallel study. So the two combined their work to produce the 25-patient MRSA study.

Both doctors said that they have received no funding from the makers of the essential oils, nor do they have financial interests in companies producing the substances.

"Most medicinals come from plants," he noted, "so the natural progression is to look to more plants for more treatments."