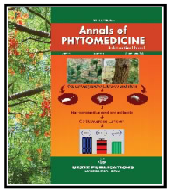
Annals of Phytomedicine 11(1): 396-404, 2022

DOI: http://dx.doi.org/10.54085/ap.2022.11.1.45

Annals of Phytomedicine: An International Journal

http://www.ukaazpublications.com/publications/index.php

Print ISSN : 2278-9839 Online ISSN : 2393-9885



Original Article : Open Access

Evaluation of antiulcer activity and GC-MS studies of *Curcuma neilgherrensis* Wt. on pyloric ligation induced wistar albino rats

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Article Info

Article history

Received 20 April 2022

Revised 7 June 2022

Accepted 8 June 2022

Published Online 30 June 2022

Keywords

GC-MS analysis

Gastric ulcers

Curcuma neilgherrensis Wt.

Pyloric ligated

Ulcer protection

Omeprazole

Abstract

Gastrointestinal ulcer pathogenicity is one of the common health disorders of present day life style and diet habits. *Curcuma neilgherrensis* Wt. is a wild species available at Andhra Pradesh from Araku valley and Seshachalam hill ranges at higher altitudes of Tirumala and Talakona along the Eastern Ghats known as Adavi Pasupu by the local herbalists and the tribes. The antiulcer study was carried out as per OECD 425 guidance to evaluate oral dose toxicity in wistar albino rats. The study was performed at dose levels, 250, 500 and 1000 mg/kg b.wt. rhizome extracts, results proved an effective potent inhibitor of ulcer index to 5.0 with 63.5 % ulcer protection at 500 mg/kg aqueous rhizome extracts of *C. neilgherrensis* on pyloric ligated gastric ulcers induced in albino rats equally to that of the standard drug omeprazole. The plant is proven to be safe without toxicity. In GC-MS studies, phytoconstituents obtained from *C. neilgherrensis* were identified, *i.e.*, humulene-6,7-epoxide; 2,7-naphthalene-diol; α-amorphene; caryophyllene; n-heptane; eucalyptol; pinocarvone; 3,5-dimethoxy toluene; curcumol; β-pinene; camphor and 2-heptanone were detected as major compounds. Hence, the aqueous and methanol extracts of rhizome were recommended as an antiulcer drug design and suggested further isolating the bioactive compounds against ulcers and microbial pathogens.

1. Introduction

Gastric ulcer is one of the most wide spread and occurs due to an imbalance between aggressive and protective factors (Alkofahi and Atta, 1999; Ojewole, 2004). The gastric mucosa is continuously exposed to potentially injurious agents such as pepsin, acid, food ingredients, bile acids, bacterial infections (*Helicobacter pylori*) and drugs (Peskar and Michetti *et al.*, 2002). These agents have been implicated in the pathogenesis of gastric ulcer including enhanced gastric acid and pepsin secretion, inhibition of prostaglandin synthesis and cell proliferation growth, diminished gastric blood flow and gastric motility (Toma *et al.*, 2005). A global study on the cause of ulcers contains high rates in *H. pylori* colonization implies a key role on diet which impact on pathogens of the disease (Health Scout, 2009).

C. neilgherrensis, a well-known medicinal plant reported from Eastern Ghats which is used to cure various diseases such as jaundice, skin diseases, bone fractures, common cold, ulcers, swellings, small pox, chicken pox, snake bites, cuts, wounds and boils by the local herbalists of Tirumala and Talakona (Chaithra *et al.*, 2013; Rasheed *et al.*, 2012).

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Nearly 80 species of *Curcuma* have been used in traditional systems of medicine like Ayurveda, Siddha and Unani (Rasheed *et al.*, 2013 and 2017). *C. neilgherrensis* possess various medicinal properties such as hepatoprotective, antioxidant, anti-inflammatory, blood purifier, anti-asthamatic, antitumor, antimicrobial, toxifier, cholagogue, carminative, *etc.* It is also reported to be used in chronic hepatitis, antiarthritic, antiseptic and menstrual disorders (Rangachari, 1991; Pullaiah, 1997; Yesodaram, 2007; Arinathan *et al.*, 2007; Gantait *et al.*, 2011; Samyudurai *et al.*, 2012; Naikodi and Ansari, 2021; Malik *et al.*, 2020).

The preliminary phytochemical screening of *C. neilgherrensis* rhizome extracts showed various secondary metabolites such as alkaloids, phenols, flavonoids, tannins, steroids, anthocyanidins, terpenoids, saponins, indoles, lignins and glycosides (Chaithra *et al.*, 2013, Rasheed *et al.*, 2013; 2017). The antibacterial activity showed the most susceptible activity on *Staphylococcus* aureus with water extracts of rhizome at 10 mg/well than the standard drug Ampicillin. Different extracts of rhizome expressed the most promising activity than the control drug on bacterial strains such as *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Staphylococcus aureus* with minimum inhibitory concentrations ranging from 0.078 to 2.5 mg (Yasodamma *et al.*, 2013; Naikodi *et al.*, 2021).

Methanol extracts of leaf extracts on *A. niger* ranges 19 to 29.5 mm and on *C. albicans* 20 to 31.3 mm zone of inhibition, and it is also observed *C. albicans* as the most susceptible ranges from 0.156 to 2.5 mg of MIC values than *A. niger* with 0.312 to 2.5 mg with methanol and alcohol extracts (Chaithra *et al.*, 2013a).The qualitative analysis of phenols, flavonoids and anthocyanidin compounds

supports the bioactivity of each component to that of the herbal uses (Yasodamma *et al.*, 2013a).

In GC-MS studies among all phytoconstituents, curcumol is one of the major constituents of *Curcuma* species and was known for the suppression of inflammation, angiogenesis, tumorigenesis, diabetes, against cardiovascular, pulmonary, skin, liver; loss of bone and muscle; depression, chronic fatigue; against neuropathic pains and acts as against antioxidant, antitumor, anticancer (Herath *et al*., 2017*)*. Compounds like thujene, caryophyllene, amorphene, humulene-6,7-epoxide present in *C. angustifolia* may act against cancer and microbes (Jena *et al*., 2017; Devi *et al*., 2021; Jyothilekshmi *et al*., 2020).

The goals for treating gastric ulcer is to relieve heal, pain the ulcers and prevent ulcer recurrence. Currently, there is no cost effective treatment. Hence, the present study aimed to screen for the antiulcer activity of methanol and aqueous rhizome extracts on pyloric ligated gastric ulcers induced wistar albino rats to study the effectiveness against ulcers and focused on GC-MS analysis.

2. Materials and Methods

C. neilgherrensis (family-Zingiberaceae) rhizome obtained from Tirumala Hills to Talakona region through the hilly part of the Eastern Ghats from April-September, 2012. The collected rhizome was taxonomically identified and authenticated by taxonomist, *viz*., literature reported in the library and a voucher specimen DC 922 was prepared and deposited in the Herbarium of SVU, Tirupati. Rhizome was thoroughly washed and dried under shade at 28 ± 2°C for 10 days then ground into a fine powder and sieved to obtain particle size range 50-150 mm. The obtained rhizome powder was stored in air sealed polythene bags at room temperature until further use.

2.1 Preparation of extract

Rhizome powder was subjected to Soxhlet extraction with methanol; simultaneously the aqueous extract was also prepared. The above obtained semisolid extracts are stored in air tight containers with lid at 4°C.

2.2 Animal selection

To study antiulcer activity in experimental male wistar rats their weight varied between 150-250 g, are purchased from Sri Venkateswara Traders, Bangalore. The animals are acclimatized under the standard laboratory conditions (temperature set at*:* 25 ± 2 °C) and uphold under cycles of 12 h of light and 12 h of dark. They are fed with *ad libitum*. The animal experimental study was designed and conducted as prescribed to the ethical norms and approved in institutional animal ethical committee, *viz*., CPCSEA/IAEC/SVU/NY-BK/dt: 19/11/2011).

2.3 Acute toxicity studies

An acute oral toxicity was carried according to the method described in Anonymous (2000) by wistar rats (where n = 6). The animals are overnight stay kept under fasting with only water to drink, and then extracts are given oral at different dose levels such as 1000, 2000, 3000 and 5000 mg/kg b.wt. with the help of intragastric tube and monitored for fourteen days. If the dose found to be mortal in two or three animals, then this dose was recorded as toxic. If, mortal rate was notice only in one animal, then dose replicated to confirm the toxic level dose. Mortality dose was recorded and followed by LD_{50} was estimated.

2.4 Pyloric ligation induced gastric ulcer

Male wistar albino rats are divided into nine groups having six animals in each group. In Group-I (as negative control) gave only distilled water at 2 ml/200 g b.wt. *via* oral route; in Group-II as labelled pyloric ligation-control; among the Group-III gave omeprazole standard drug at 20 mg/kg b.wt dose; whereas in Groups-IV-IX received rhizomes extracts (aq. and meth) at the concentration of 250, 500 and 1000 mg/kg b.wt., respectively. Aq. and meth. extracts are offered for a period of seven days. On the seventh day, after 45 min of sample extract and standard drug omeprazole treatment; gastric ulcers are then induce into the rats. The respective group rats kept under fast for one day (24 h) before the pyloric ligation, but only received water. After the end of the day duration, *i.e*., 24 h starvation, rats are subjected to anaesthesia with the help of pentobarbitone sodium (35 mg / kg). The muscle mass is usually sufficient for accurate administration of small volumes of injecting pentobarbitone sodium. The abdomen was cut to open by midline incision and a ligature was placed at the pylorous ending of the stomach. The abdomen was then closed in two layer. Before 1 h of pylorus ligation water was with held and till the end of the 4 h period. The stomach of selected rats again opened immediately to ligate the cardiac end. In order to study the conditions for the antiulcer activity, the stomach cut open along the greater curvature, extracted out and washed under running tap water (Shay *et al*., 1945; Kulkarni, 1999).

2.5 Macroscopic evaluation of stomach

The stomach was cut opened through the greater curvature then rinsed to remove gastric contents with the aid of saline water. The blood clots are examined under magnifier lens (10X) to detect the formation of ulcer. The evaluation of ulcer index was estimated as per the method Vogel and Vogel (1997).

The ulcer index (UI) is calculated as $UI = (Un + Us + Up) \times 10^{-1}$

2.6 Percentage inhibition of ulceration

Percentage inhibition of ulceration was calculated as per the method described by Takagi *et al.* (1969).

2.7 Volume of gastric juice

After dissection, a syringe gastric secretion was taken into labelled graduated plastic micro-centrifuge tubes.

2.8 Gastric-juice

Gastric-juice was taken and for about 10 min it is centrifugated at 2000 rpm, aliquots of 1ml gastric juice taken from the supernatant liquid layer are mixed with 1 ml distilled water and its pH recorded (Ramachandran *et al.*, 2008).

2.9 Free-acidity

Take an aliquot of 1 ml gastric juice into a 50 ml conical flask mixed with 10 ml of water and add 2-3 drops of Topfer's reagent as indicator, followed by titration with 0.01 N sodium hydroxide solution till the end point color change to orange was recorded. The free-acidity analyzed as per the method described by Muralidharan and Srikanth (2009).

2.10 Total acidity

Titrate with 0.01 N sodium hydroxide solution and phenolphthalein used as indicator, to notice a colour change to permanent pink color and recorded. The volume of 0.01 N NaOH consumed was noted and total acidity was calculated as per Rajkapoor *et al*. (2002).

2.11 Statistical analysis

The data obtained during the study was expressed as mean ± SE from the various groups after statistical analysis using one-way ANOVA parameter, which is followed by Dunnett's test. The finding are indicated with asterisk which denotes as p^{*}<0.05 (significant); p^{**}<0.01 (more significant); p^{ns}Ã0.05 (not significant).

2.12 Histopathological evaluation

The gastric tissue samples are fixed in neutral buffered formalin for 24 h. Sections of tissue from stomachs are histopathologically examined to study the antiulcer activity of *C. neilgherrensis* (Culling, 1974). The processing of tissues are kept fixed in paraffin blocks and length of 5 µm thick sections using a microtome. The sections are stained with hematoxylin and slides are made with eosin to examine under microscope to determine the nature of pathomorphological changes or formations such as congestion, hemorrhage, erosions and oedema aid of an arbitrary scale to assess the severity.

Table 1: Antiulcer activity of *C. neilgherrensis*

Treatment	Conc. mg/kg b.wt	Ulcer index	Ulcer protection (%)	Gastric juice (ml)	pH of gastric juice	Free acidity meq/l	Total acidity meq/l
Control	-	0	0	2.2 ± 0.08	4.8 ± 0.08	10.2 ± 0.08	20.2 ± 0.16
Pyloric ligation	-	13.7 ± 0.6	-	6.7 ± 0.09	2.2 ± 0.11	26.5 ± 0.50	57.5 ± 0.95
Omeprazole	20	6.2 ± 0.16	54.74	2.6 ± 0.08	4.7 ± 0.06	10.6 ± 0.74	22.6 ± 0.74
Rhizomeaqueous	250	7.4 ± 0.03**	45.90	4.7 ± 0.05**	3.7 ± 0.03**	16.5 ± 0.38**	16.1 ± 0.27**
	500	5.0 ± 0.04**	63.50	2.7 ± 0.02**	4.6 ± 0.03**	15.3 ± 0.38**	15.5 ± 0.38**
	1000	3.5 ± 0.03**	74.45	1.8 ± 0.03**	5.4 ± 0.05**	14.1 ± 0.27**	13.5 ± 0.38**
Methanol	250	8.2 ± 0.03**	40.14	5.1 ± 0.05**	3.6 ± 0.04**	17.3 ± 0.30**	17.1 ± 0.27**
	500	6.3 ± 0.07**	54.01	4.3 ± 0.04**	4.7 ± 0.04**	16.5 ± 0.38**	15.3 ± 0.38**
	1000	4.3 ± 0.04**	63.15	2.4 ± 0.07**	5.4 ± 0.04**	15.6 ± 0.30**	13.1 ± 0.36**

All the data are expressed as mean ± SEM, n=6; *p<0.05 and **p<0.01 when compared with control group; One-way ANOVA, followed by Dunnett's test.

Table 2: GC-MS evaluation of *C. neilgherrensis* rhizome extracts

S. No.	Relative abundance	Retention time	Name of the phytoconstituents	Molecular formula	Molecular weight (g/mol)	Activity
1.	10	3.60	2-heptanone	$C_7H_{14}O$	114.18	Flavour and fragrance agents
2.	15	5.25	β-pinene	$C_{10}H_{16}$	136.23	Antimicrobial, Antitumour, Anticancer, Antioxidant
3.	13	7.52	camphor	$C_{10}H_{16}O$	152.23	Fatigue, Minor heart symptoms
4.	26	10.30	eucalyptol	$C_{10}H_{18}O$	154.24	Non purulent rhinosinusitis, Mucus hyper secretion, Anti-inflammatory
5.	28	11.53	n-heptane	$C_{17}H_{16}$	100.21	Anixolytic, Sedative and skeletal muscle relaxant properties
6.	17	13.32	3,5-dimethoxy toluene	$C_9H_{12}O_2$	152.19	Anti-inflammatory
7.	67	14.26	2,7-napthalene-diol	$C_{10}H_8O_2$	160.16	Antioxidant
8.	24	15.10	pinocarvone	$C_{10}H_{14}O$	150.22	Flavour and fragrance agents, Antimicrobial, Antioxidant
9.	99	15.90	humulene-6,7-epoxide	C_5H_{24}	204.35	Anti-inflammatory
10.	60.1	17.91	α-amorphene	$C_{15}C_{24}$	204.35	Antimicrobial, Antioxidant
11.	56	18.51	caryophyllene	$C_{15}H_{24}$	204.36	Anti-inflammatory, Antioxidant, Antitumor, Anticancer
12.	18	13.33	curcumol	$C_{15}H_{24}O_2$	236.34	Antioxidant, Antitumour, Anticancer

2.13 GC-MS studies

The methanolic extract of *C. neilgherrensis* was subjected to GC-MS analysis. GC-MS SHIMADZU QP2010 instrument with Elite-DB-5M column was used and the software version 2.53 software. Initially, the temperature was kept at 70ºC and then gradually increased up to 300 ºC at 10.0/35.0 min. 4.0 µl of the sample was injected and pure helium gas (99.995 %) was used as a carrier gas, flow rate as 1.5 ml/min. The sample injector temperature kept at 260ºC and the split ratio is 20 throughout the experiment periods. The ionization mass spectroscopic analysis was done at 70 eV. The mass spectra recorded in mass range 40-1000 m/z. Identification of components separated on elution through the column was done based on comparison of their mass spectra (Yang *et al*., 2006; Sriram, 2011).

3. Results

Antiulcer activity of rhizome crude extracts of *C. neilgherrensis* on pyloric ligation ulcer in male wistar albino rats showed the following results, *i.e.*, Table 1 and Figures 1-3. In GC-MS studies, the phytoconstituents of the methanolic rhizome extract of *C. neilgherrensis* are presented in Table 2 and Figure 4.

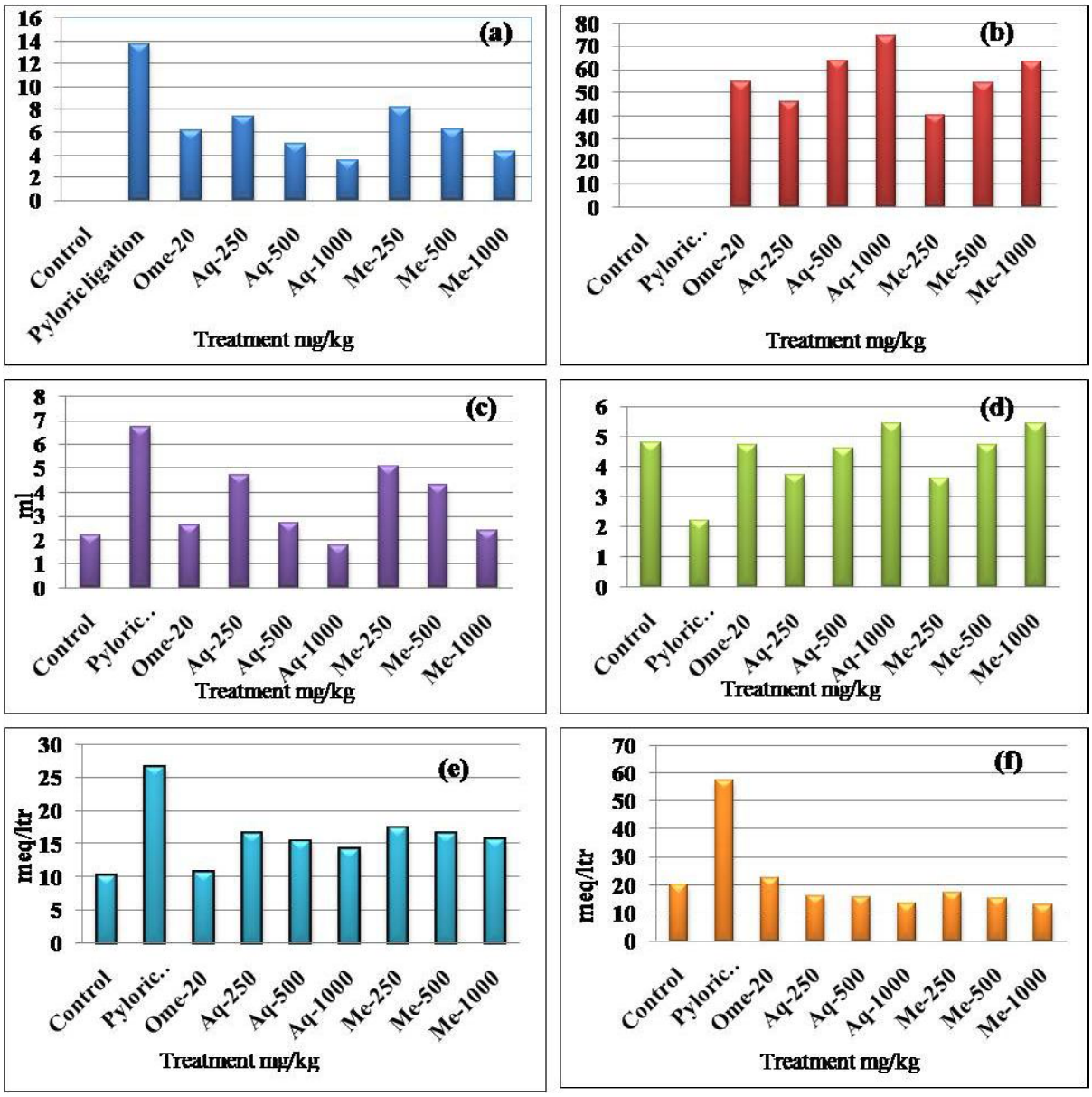

Figure 1: Antiulcer activity of *C. neilgherrensis* rhizome extracts: (a) Ulcer index, (b) % Ulcer protection, (c) Volume of gastric juice, (d) pH, (e) Free acidity and (f) Total acidity.

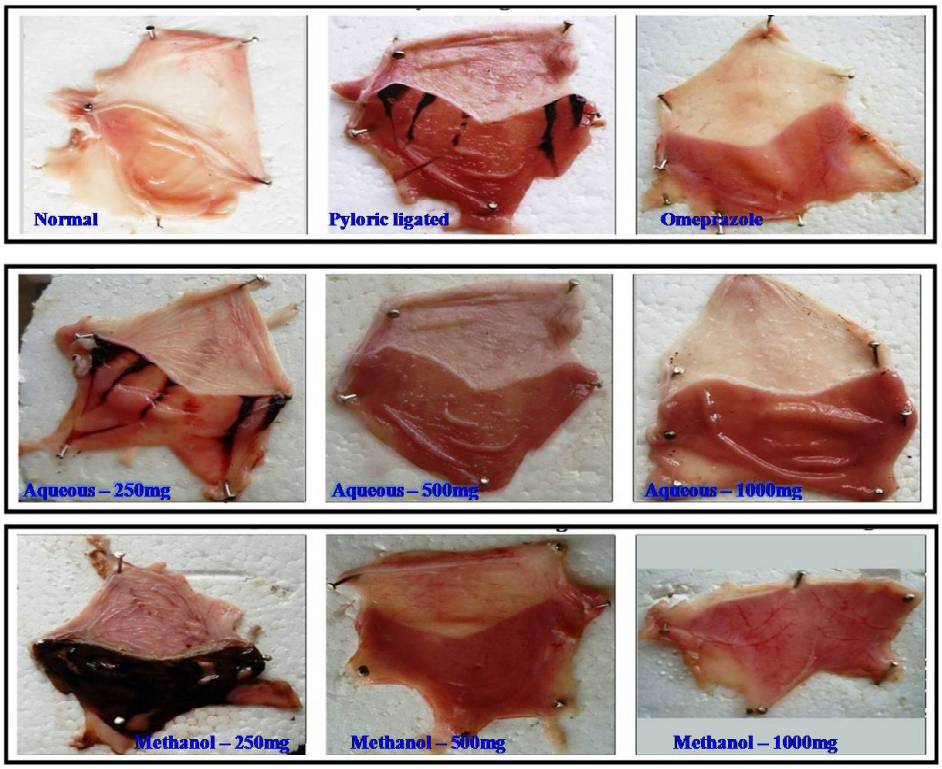

Figure 2. Antiulcer activity of *C. neilgherrensis* rhizome extracts.

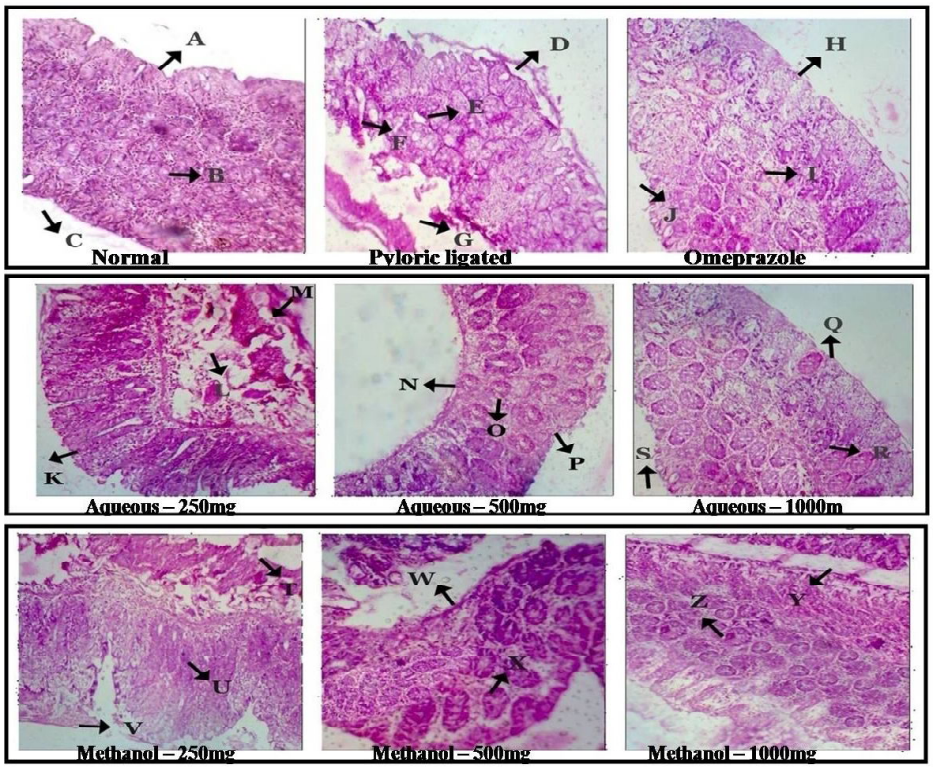

Figure 3: Histopathological studies of gastric lesions of *C. neilgherrensis* rhizome extracts.

Normal A: Normal lining of epithelium, B: Intact mucosa, C: Normal sub mucosa Pyloric ligated, D: Severe damaged epithelium, E: Leukocyte infiltration, F: Sever mucosal lesions, G: Damage sub mucosa Omeprazole-standard drug, H: Normal lining of epithelium, I: Intact mucosa, J: Normal sub-mucosa Aqueous-250 mg, K: Mild damage to epithelium, L: Mild damage to mucosa, M: Mild leukocyte infiltration Aqueous-500 mg,

N: Mild damage to epithelium, O: Intact mucosa, P: Normal lining of epithelium Aqueous-1000 mg, Q: Intact mucosa, R: Normal sub-mucosa, S: Mild damage to epithelium Methanol-250 mg, T: Mild leukocyte infiltration, U: Mild damage to mucosa, V: Mild damage to epithelium Methanol-500 mg, W: Intact mucosa, X: Normal lining of epithelium Methanol-1000 mg, Y: Intact mucosa and Z: Normal sub-mucosa.

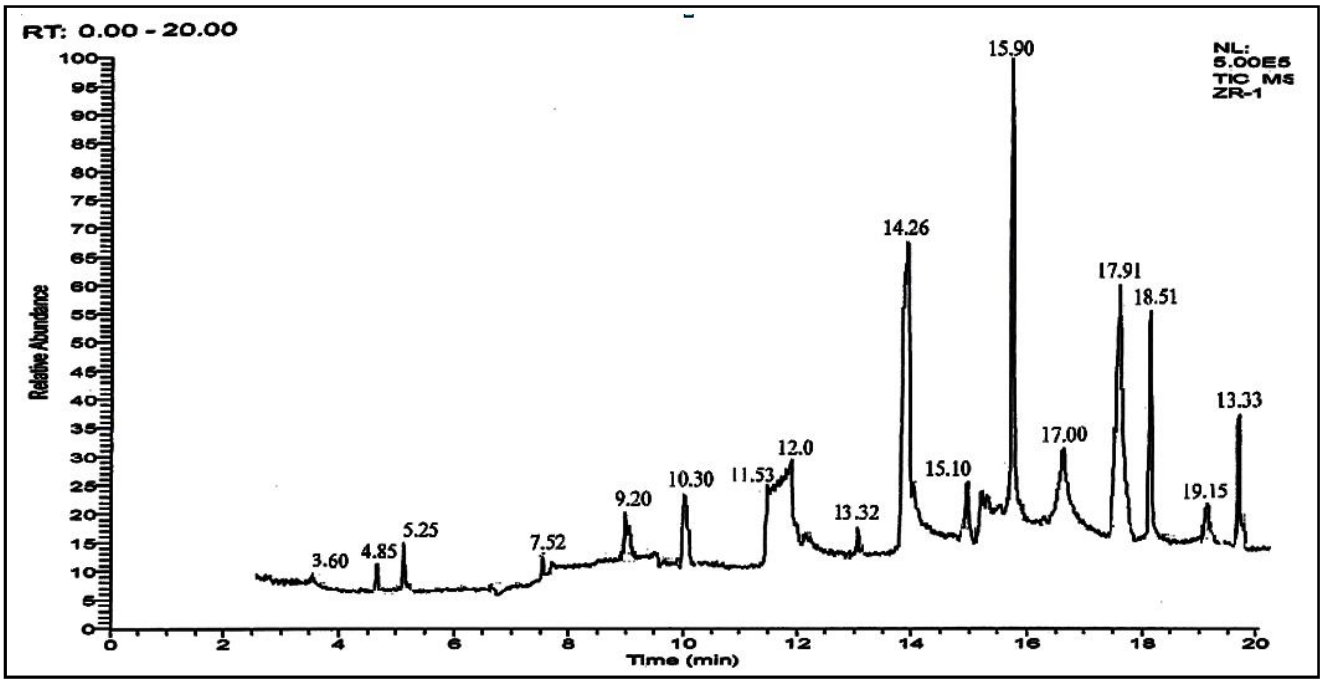

Figure 4: GC-MS studies of *C. neilgherrensis* rhizome extracts.

4. Discussion

The studies executed for acute toxicity in aq. and meth. extract of *C. neilgherrensis*, single oral dose not exhibited prominent toxicity factors and mortality on experimental wistar rats for the first 4 h and under daily dose for fourteen days and not exhibited any toxicity, no other factors or signs and symptoms changes in b. wt. or intake of food; psychomotor activity; restlessness parameter, respiratory distress parameter, diarrhoea, convulsions and coma. The drug was found to be safe at the tested dose levels of 1000, 2000, 3000, 4000, and 5000 mg/kg b.wt according to 425 organization for economic co-operation and development (OECD) guidelines.

The effective antiulcer index was noticed with *C. neilgherrensis* aqueous and methanol extracts of rhizome as 5.0 and 6.3 at 500 mg/kg b.wt against pyloric ligated albino rats with 13.7 ulcer index. At 1000 mg/kg, it was 3.5 and 4.3, respectively when compared to the omeprazole treated rats with 6.2 ulcer index; with 54.74. % of ulcer protection is proportionate to that of the herbal drug extracts treated rats as 63.50 % and 54.01 % at 500 mg and 74.45 % and 63.15 % at 1000 mg/kg with aqueous and methanol extracts of the rhizome. It was also observed the increase in gastric juice was 6.7 ml, free acidity 26.5 meq/l and total acidity 57.5 meq/l in pyloric ligated rats. Whereas, it was decreased with methanol extracts of rhizome at 1000 mg/kg b.wt and the standard drug treated rats at 20 mg/kg as 1.8 and 2.4 ml gastric juice; free acidity 14.1, 15.6 meq/l; total acidity 15.5 and 13.1 meq/l, respectively. pH is decreased to 2.2 in the ulcer induced rats than the normal rats 4.8 and it is increased in herbal drug treated rats as 5.4 and in the standard drug treated rats as 4.7, respectively which is closer to that of the normal rats.

Histopathological finding under the conditions of pyloric ligated gastric lesions in the control group for ulcer exhibit more changes and suffered damage to the oedema, gastric mucosa and also in the region of leucocyte infiltration part of the sub-mucosal layer. Rats subjected to pre-treatment with aqueous and methanol extracts shows comparatively better protected upon gastric mucosa and significant saw reduction into the ulcer region, decreased oedema or non-existence of sub-mucosal and leukocyte infiltration. The aq. and meth. extracts are proved to exhibit the cytoprotective effect clearly in the dose dependent. The similar findings with *C. longa* experiment in alcoholic extracts at 500 mg/kg; root powder of *C. zedoaria* extract at 200 mg/kg; on the other hand, alcoholic extracts obtained from *C. caesia* at 500 mg/kg. However, the alcoholic extracts of *C. longa* showed significant anti-ulcerogenic activity at 500 mg/kg on rats ulcer index was significantly reduced on pyloric ligation induced rats at the end of 6 h by 0.33 to 1.00. Whereas, duodenal ulcers were 0.37 to 0.26; gastric juice was 1.5 to 2.00 as in control and compared to normal rats, respectively (Rafatullah *et al*., 1990); whereas, *C. zedoaria* root methanolic extract at 200 mg/kg b.wt on pyloric ligated albino rats reduced significantly the free-acid, total-acid and ulcer index in comparison with omeprazole at 30 mg/kg b.wt. The ulcer index was noticed as 1.5; free acid 28.23 meq/l; gastric volume 1.96 ml to that of the standard drug, respectively (Gupta *et al*., 2003).

Curcuma caesia ethanolic extracts at 500 mg/kg b.wt on aspirin induced ulcers were found to significantly decreased ulcer index by 4.18 to that of standard drug ranitidine as 1.6 and in the aspirin induced control rats, it was 12.29; similarly gastric juice volume 1.14 ml; free-acidity 46.40 meq/l; total-acidity 66.80 meq/l; gastric-mucus

was enhanced to 17.45 ml with that of normal rats, respectively (Das *et al*., 2012).

C. neilgherrensis reveals the presence diverse phytoconstituents nature and exhibiting and regulating the antiulcer activity such as caffeic acid obtained from rhizome and leaf (Olthof *et al*., 2001); melilotic acid isolated from the rhizome (Lewis and Lewis, 1977). Salicylic acid isolated from leaf and rhizome (Dean, 1952); apigenin isolated from leaf (Dayong *et al*., 2009); quercetin isolated from leaf and rhizome (Shoskes, 1999); cyanidin isolated from the rhizome (Sasaki *et al*., 2007) showed good therapeutic response.

Further *C. neilgherrensis* rhizome extracts earlier showed effectiveness against human bacterial and fungal pathogens, anthelmintic activity and its antioxidant activity also stimulate the synthesis of the prostaglandins against ulcerogenic activity by inhibiting the non-steroidal anti inflammatory drugs (NSAID) activity by increasing SOD, GSH and CAT levels and protecting gastric mucosal layer.

The methanolic extract of *C. neilgherrensis* upon subjected to the GC analysis coupled with MS had yielded to determine few number of compounds of their relative abundance, retention time, phytoconstituents, molecular weight and their activities are given in Table 2 and as shown in Figure 2. The GC-MS results showed the presence of total twelve major compounds; namely, 2-heptanone; α-pinene; camphor; eucalyptol; n-heptane; 3,5-dimethoxy toluene; 2,7-napthalene-diol; pinocarvone; humulene-6,7-epoxide; α-amorphene; caryophyllene; curcumol respectively. Most prominent compound in *C. neilgherrensis* rhizome extracts showed phytoconstituents with relative abundance (R.A.) and molecular weight (M.Wt.) as humulene-6,7-epoxide (R.A.:99; M.Wt.: 204.35); 2,7-naphthalene-diol (R.A:67; M.Wt:160.16); β-amorphene (R.A:60.1; M.Wt: 204.35); caryophyllene (R.A:56; M.Wt:204.36); n-heptane (R.A:28; M.Wt: 100.21); eucalyptol (R.A:26; M.Wt: 154.24); pinocarvone (R.A:24; M.Wt: 150.22); 3,5-dimethoxy toluene (R.A:17; M.Wt: 152.19); curcumol (R.A:18; M.Wt: 236.34); β-pinene (R.A:15; M.Wt:136.23); camphor (R.A:13; M.Wt:152.23); 2-heptanone (R.A:10; M.Wt: 114.18) were detected in GC-MS analysis.

5. Conclusion

From this study, we can conclude that studies with plant sources can result in novel and effective pattern of treatment. Current stalemates of modern medicine in the management of various ailments incline research tendencies to traditional medicine. In this respect, traditional medicine has introduced good protocols for treatment of various gastrointestinal disorders. All of the remedies presented here had adequate evidence from traditional or scientific source for their efficacy in management of ulcers.

The study concludes that plant sources are novel and act towards effective treatment. An effective antiulcer activity was proved in the present study in aq. extract of C. *neilgherrensis at* at 500 mg/kg dose showing 3.5 as ulcer index and 63.5 % ulcer protection. The pH was also maintained to that of normal rats and proved through histopathological studies. The study shows suppressed gastric juice levels, free-acidity and total-acidity to that of the pylorous ligated ulcer induced in rats to that of omeprazole treated rats group. It is evident from GC-MS studies that *C. neilgherrensis* has various phytoconstituents and has a vital role in phytopharmaceutical importance. The antiulcer studies are proved to be effective for the plant extract against ulcers. The plant *C. neilgherrensis* need to be conserved for future generations both *in vivo* conditions and also to develop protocols for *in vitro* propagation.

Acknowledgements

The authors are grateful to the University Grants Commission (UGC) New Delhi for Financial assistance. The authors also in debt to the Department of Botany, S.V.U College of Sciences, Sri Venkateswara University, Tirupati and also thanks to the Director General, CCRUM, New Delhi and Director Incharge, NRIUMSD, Hyderabad for support and constant encouragement.

Conflict of interest

The authors declare no conflicts of interest relevant to this article.

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Citation **Dandu Chaithra, Mohammed Abdul Rasheed Naikodi, Yasodamma Nimmanapalli, Baira Venkatesham, Mohd Nazeer, Javed Inam Siddiqui and Ahmed Minhajuddin (2022). Evaluation of antiulcer activity and GC-MS studies of *Curcuma neilgherrensis* Wt. on pyloric ligation induced wistar albino rats. Ann. Phytomed., 11(1):396-404. http://dx.doi.org/10.54085/ap.2022.11.1.45.**