International Journal of Phytomedicine 8 (2016) 287-295
http://www.arjournals.org/index.php/ijpm/index

Original Research Article

ISSN: 0975-0185

Antiulcer and antioxidant potential of *Zizyphus jujuba* Mill root extract in Aspirin and ethanol induced gastric ulcers.

Sameena Alam[1], MD Sajid Hussain[2], Madhavi K Reddy[1], MV Reddy[1], Rajesh Kumar Gupta[2]*

***Corresponding author:**

Rajesh Kumar Gupta

[1]Sree Dattha Institute of Pharmacy, Nagarjuna Sagar road, Rangareddy Distt. (Telangana)-INDIA
[2]Drug Development Laboratory Group, School of Vocational Studies and Applied Sciences, Gautam Buddha University, Yamuna Expressway, Greater Noida (U. P)-INDIA

Abstract

The root of *Zizyphus jujuba* Mill. (*Rhamnaceae*) (ZJ) has been used to treat mouth ulcers as indigenous medicine. However there is no scientific report of its use for protection and treatment of gastric ulcers.

The aqueous root extract of ZJ (AREZJ) was evaluated for antiulcerogenic potential in aspirin and ethanol induced ulcer models in Wistar rats along with *in vitro* antioxidants potential. Single dose toxicity studies were carried out to determine LD_{50}.

Two doses i.e. 150 and 250 mg/kg b.wt were evaluated for antiulcer activity by measuring ulcer index and percentage of ulcer healing in two of the ulcer models. Antioxidants activity was estimated *in vitro* by DPPH, H_2O_2 free radical scavenging and reducing power assay. Phytocostituents were determined by standard method.

Based on ulcer index, percentage protection of 76.92% in aspirin model and 70% in ethanol model were noted with a dose of 250 mg/kg b.wt of AREZJ, whereas standard drug omeprazol (50 mg/kg b.wt) showed 80.77 % and 80 % protection in aspirin and ethanol models respectively. AREZJ showed 89.2% DPPH and 88.5% H_2O_2 free radical scavenging activity at concentration of 200 µg/ml and 80 µg/ml respectively. AREZJ also exhibited 87.5% reducing power at 50 µg/ml. Phytochemical screening of AREZJ showed presence of alkaloids, carbohydrates, flavanoids, glycosides, proteins and tannins. No mortality was noted till 2500 mg/kg b.wt of AREZJ, indicating higher LD_{50} value.

AREZJ was found to have antiulcerogenic effect, which could be related to its antioxidant potential.

Keywords: Antiulcer, Antioxidant potential, Ethanol induced gastric ulcer.

Introduction

Zizyphus jujuba Mill. also known as jujube or Chinese date is a tree that belongs to the family *Rhamnaceae.* It grows worldwide specially in south Asia between Lebanon, Iran, Pakistan, India, Bangladesh, Nepal, the Korean peninsula, southern and central China. It is highly acceptable wild vegetable across south India. For many years fruit and its seeds are used in Chinese and Korean traditional medicine. Various part of *Zizyphus jujuba* has been found to posses activities like hypnotic-sedative and anxiolytic, anti-Cancer, antioxidant, anti-inflammator, immunostimulant, cardiovascular, antiulcer, anti-obese, antifertility / contraceptive, antifungal, hypoglycemic and wound healing properties [1-12].

Ulcer is the asymptomatic gastrointestinal disorder defined as a breach in mucosa of alimentary tract, which extends through the muscularies mucosa into the submucosa or deeper and occurs due to imbalance between aggressive factors like acid, pepsin, *Helicobacter pylori* [13] and defensive factors like prostaglandins, gastric mucus, bicarbonate secretion, innate resistance of mucosal cells [14-15]. The wide incidence and prevalence of ulcer is also attributed due to several other factors such as stress, regular or frequent use of non-steroidal anti inflammatory drugs and reactive oxygen species and bacterial infections [16].

Medicinal plants have been an invaluable source of therapeutic agents to treat various disorders including peptic ulcer disease [17-

18]. An indigenous drug possessing fewer side effects is the major thrust area of the present day research aiming for a better and safer approach for the management of peptic ulcer disease. Roots of *Zizyphus jujuba* Mill were used to treat mouth ulcers as indigenous medicines but there is no scientific report of its use for protection and treatment of ulcers. Present study was designed to investigate antiulcer and antioxidant activity of *Zizyphus jujuba* Mill. root extract in experimental animal model, it's possible mode of action and nature of phytoconstituents present in the root extract.

Materials and Methods

Plant material. The roots of *Zizyphus jujuba* Mill. were collected in November from the local area of Hayathnagar, Andhra Pradesh, India. It was authenticated by Prof. P.V. Prasanna, Scientist-'E'- In–Charge, Botanical Survey of India (BSID/2012), Hyderabad. A voucher specimen is submitted for the same.

Extract Preparation. Fresh roots of *Zizyphus jujuba* were collected, dried in shade and powdered using hand grinder to make a coarse powder. 100 grams of powder was extracted with 2 liters of distilled water by cold maceration at room temperature for 24 hrs and filtered. The extracts so obtained were lyophilized to powder form (6.5% w/w) and kept at 4^0C for further studies. For animal testing, the extract was prepared fresh in aqueous suspention.

Experimental animals. Wistar rats of either sex with an average weight of 150-180 gram were selected for the study and divided into various groups each contains 6 animals. Animals were housed under standard condition of temperature (24 $\pm$ 1^0C), relative humidity (45-55%), 12:12 hour light/dark cycle with free access to water. Feeding was done with commercially available rat feed pellets. The food was withdrawn 24 hours before the experiment but allowed free access to water. The experiments were carried out according to guidelines of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) New Delhi, India, numbered 1636/PO/a/12/CPCSEA that complies with international laws of ISNA and the procedures were approved by Institutional Animal Ethics Committee (IAEC) of Sree Datta Institute of Pharmacy.

Oral Toxicity Studies [19]. An initial toxicity profiling was carried out to determine any immediate toxic effect in aqueous root extract of *Zizyphus jujuba* Mill.(AREZJ). Different doses of AREZJ were investigated according to the OECD (Organization for Economic Co-operation and Development) Guideline No. 423. Doses were calculated according to body weight of the animals. Single doses of 125, 250, 500, 1000, 2000 and 2500 mg/kg b.wt were fed using oral canula to various groups of animals and control group were fed with equal volume of water. Animals were observed for gross behavioral, neurologic, autonomic, and toxic effect continuously. Food consumption, feaces and urine were examined at 2 hrs and then at 6 hrs intervals for 24 and 48 hrs.

***In-vivo* Antiulcer activity.** Antiulcer activity was evaluated in aspirin and ethanol induced ulcer models. Based on oral toxicity studies 2500 mg/kg b.wt dose was considered as cutoff value for antiulcer activity in Wistar rats. Two different doses i.e 150 mg/kg b.wt and 250 mg/kg b.wt were selected for further studies.

Aspirin induced ulcer model [7,20]: For this study groups were as follows;

Group 1: Negative control: Aspirin (200 mg/kg b.wt) + distilled water

Group 2: Positive control: Aspirin (200 mg/kg b.wt) + omeprazole (50 mg/ kg b.wt)

Group 3: Treated group: Aspirin (200 mg/kg b.wt) + 150 mg/kg b.wt of AREZJ

Group 4: Treated group: Aspirin (200 mg/kg b.wt) + 250 mg/kg b.wt of AREZJ

Initially group-2, 3 and 4 were fed with omaprazole or AREZJ and group-1 with equal volume of distilled water. After 1 hour, ulcers were induced in animals of all groups by feeding 200 mg/kg b.wt of aspirin. The animals were scarified after 4 hours by an overdose of anesthetic ether. Stomachs were removed, prepared cross section along with greater curvature were pinned on a soft board.

Ethanol induced ulcer model [7, 20]. In this case, animals were grouped as above and fasted for 24 hrs (with free access to water) to ensure an empty stomach. Group-2, 3 and 4 were fed with omaprazole or AREZJ and Group-1with equal volume of distilled water. After 1 hour ulcers were induced to animals of all groups by feeding 1 ml of 90% ethanol. The animals were scarified after 1 hour and stomachs were removed. Prepared cross section along with greater curvature was pinned on a soft board.

Measurement of ulcer index. Protection from ulcer formation by the standard drug and AREZJ were established by comparing ulcer scores of treated with untreated negative control groups. The ulcer scores were measured microscopically with the help of hand lens (10X). Criteria for scoring of ulcers are summarized in Table-1. Mean ulcer score for each animal was expressed as ulcer Index.

$$\text{Ulcer index; } U_I = (U_N + U_S + U_P) \times 10^{-1}$$

Where; U_N - Average number of ulcers per animal, U_S - Average no. of severity score, U_P - Percentage of animals with ulcers

The percentage of ulcer protection was determined as follows:

$$\text{Percentage protection} = (1 - Ut/Uc) \times 100$$

Where; U_t-Ulcer index of treated groups (Omeprazole/AREZJ), Uc-Ulcer index of untreated group (Negative control)

Table-1: Arbitrary scoring system used for measuring ulcer index

Ulcer	Score
Normal coloured stomach	0
Red colouration	0.5
Spot Spot ulcer	1
Hemorrhagic streaks	1.5
Deep ulcers	2
Perforations	3

In-vitro Antioxidants activity: Following methods were employed to assess antioxidant activity of AREZJ

DPPH free radical scavenging assay [21]. DPPH (1,1-diphenyl 2-picryl hydrazyl) free radical scavenging assay was carried out as described by Molyneux, 2004. Solution of DPPH (0.006% w/v) was prepared in 95% methanol. Lyophilized root extract was dissolved in 95% methanol to prepare stock solution of 1 mg/ml and dilutions were prepared (100-200 µg/ml). Freshly prepared DPPH solution was mixed with different concentration of root extract (final volume 2 ml), incubated for 30 minutes in dark. Absorbance was measured at 517 nm. All the measurements were performed in triplicate. Ascorbic acid was used as standard. % scavenging of the DPPH free radical was calculated using the following equation;

$$\text{DPPH scavenging effect (\%)} = (A_0 - A_1 / A_0) \times 100$$

Where, A_0 = absorbance of the control (methanol) and A_1 = absorbance of extract/standard.

Hydrogen peroxide free radical scavenging activity [22]. An aliquot of H_2O_2 (2 mM) and various concentrations (10-80 µg/ml) of AREZJ samples were mixed (1:0.6 v/v) and incubated for 10 min at room temperature. After incubation, the absorbance of hydrogen peroxide at 230 nm was determined against a blank solution containing phosphate buffer without hydrogen peroxide. Ascorbic acid was used as standard. % scavenging activity of H_2O_2 free radicals was calculated as follows:

$$\%\ \text{scavenging activity } (H_2O_2) = (A_0 - A_1 / A_0) \times 100$$

Where, A_0: absorbance of the H_2O_2 in phosphate buffer, A_1: absorbance of the AREZJ/standard.

Reducing power assay [23]. Stock solution of the AREZJ (final concentration of 10-50 µg/ml) were mixed with phosphate buffer (2.5 ml of 0.2 M, pH 6.6) and potassium ferricyanide $[K_3Fe(CN)_6]$ (2.5 ml of 1% aqueous solution). The mixture was incubated at 50ºC for 20 minutes and 2.5 ml of 10% TCA (Trichloroacetic acid) was added. Mixture was centrifuged at 3,000 rpm for 10 min, upper layer (2.5 ml) was removed and diluted with equal volume of double distilled water and added 0.5 ml of 0.1% $FeCl_3$. Absorbance was measured at 700 nm. Percentage reducing power was calculated as follows;

$$\%\ \text{Reducing Power} = (A_0 - A_1 / A_0) \times 100$$

Where, A_0-absorbance of the $[K_3Fe(CN)_6]$ in phosphate buffer, A_1-absorbance of the AREZJ/standard.

Phytochemical Screening [24]. AREZJ was subjected to phytochemical screening for the presence of various chemical entities viz. alkaloids anthraquinone, carbohydrates, flavonoids, glycosides, proteins, tannins and terpinoids as described, Harborne, 1973.

Statistical Analysis. Results are expressed as mean ± S.E.M. of triplets. Significant values were compared with * $P < 0.01$ control vs treated groups using one-way ANOVA followed by Dunnet's test.

Results

Oral Toxicity. No toxicity and mortality was noted till 2500 mg/kg b.wt of the root extract, indicating high level safety for its consumption. LD50 was higher than tested dose of 2500 mg/kg b.wt.

Antiulcer activity

Aspirin Induced Ulcer Model. Mean ulcer index of 2.167+0.307 was found in Aspirin induced ulceration which was significantly reduced to 0.416+0.153 by standard drug omeprazole. Similarly AREZJ has shown significant reduction ($P<0.01$) in mean ulcer index by 0.583+ 0.153 and 0.5+ 0.129 with the doses of 150 and 250 mg/kg b.wt respectively. Percentage ulcer protection of 80.77% was noted in case of omeprazole whereas AREZJ showed 73.08 and 76.92% protection with 150 and 250 mg/kg b.wt of doses respectively (Table-2).

Table-2: Antiulcer activity AREZJ in aspirin induced ulcer model.

Groups	Treatment	Mean Ulcer Index	% Protection
Group 1	Negative control (aspirin 200 mg/kg bwt)	2.167 ± 0.307*	No protection
Group 2	Positive control (omeprazole 50mg/kgbwt)	0.416± 0.153*	80.77
Group 3	Aqueous root extract (150 mg/kg bwt	0.583± 0.153*	73.08
Group 4	Aqueous root extract (250 mg/kg bwt	0.5 ± 0.129*	76.92

Values are expressed as mean ulcer index ± S.E.M. n = 6. Significant values were compared with * $P<0.01$ Control Vs treated groups using one way ANOVA followed by Dunnet's test.

Ethanol Induced Ulcer. Mean ulcer index of 2.50+0.341 was observed in ethanol induced ulcer model which is significantly (P<0.05) reduced to 0.500+0.129 by standard drug omeprazole. Similarly AREZJ has shown significant reduction (P<0.01) in mean ulcer index by 1.583+0.374 and 0.75+0.111 with the doses of 150 and 250 mg/kg bwt respectively. Percentage ulcer protection of 80 % was noted in case of omeprazole whereas AREZJ showed 36.68 and 70 % protection with 150 and 250 mg/kg b.wt doses respectively (Table-3). A dose dependent response was observed with AREZJ.

Table-3: Antiulcer activity AREZJ in etahnol induced ulcer model

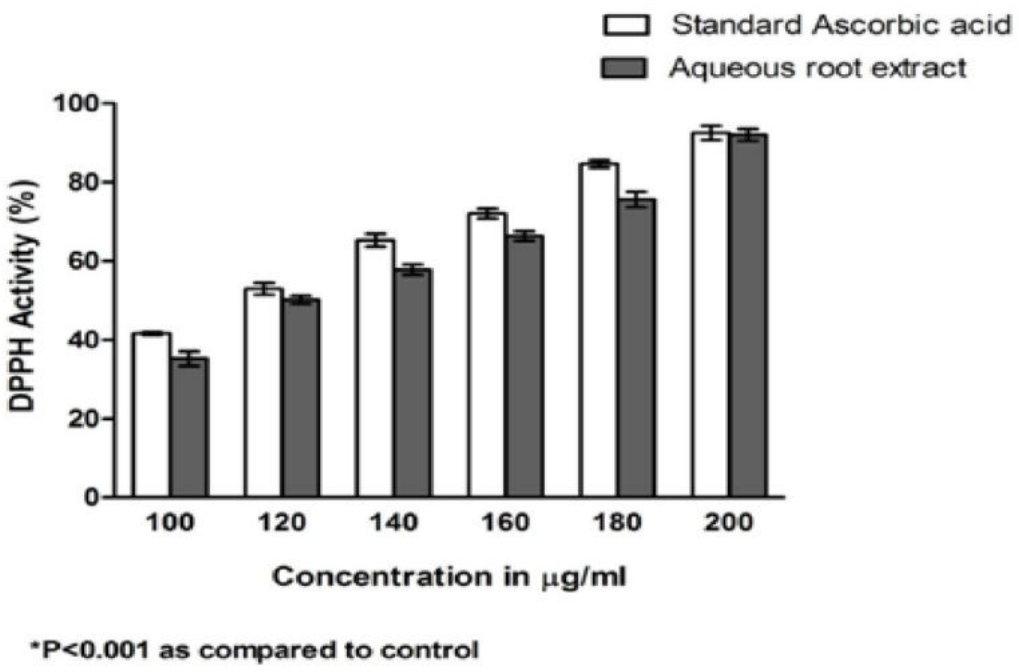
Groups	Treatment	Mean Ulcer Index	% Protection
Group 1	Negative control (1 ml 90% ethanol)	2.5± 0.341*	No protection
Group 2	Positive control (omeprazole 50 mg/kgbwt)	0.5 ± 0.129*	80
Group 3	Aqueous root extract (150 mg/kg bwt)	1.583±0.374 **	36.68
Group 4	Aqueous root extract (250 mg/kg bwt)	0.75 ± 0.111**	70.00

Values are expressed as mean ± S.E.M. n = 6. Significant values were compared with *=*P*<0.05, **= *P*<0.01, Control Vs treated groups using one way ANOVA followed by Dunnet's test.

In-vitro Antioxidants activity

DPPH free radical Scavenging activity. AREZJ showed 35% DPPH scavenging activity at 100 µg/ml which was further increased to 89.2 % at highest concentration tested i.e. 200 µg/ml (Figure-1). Standard ascorbic acid showed 93.5% DPPH scavenging activity at 200 µg/ml.

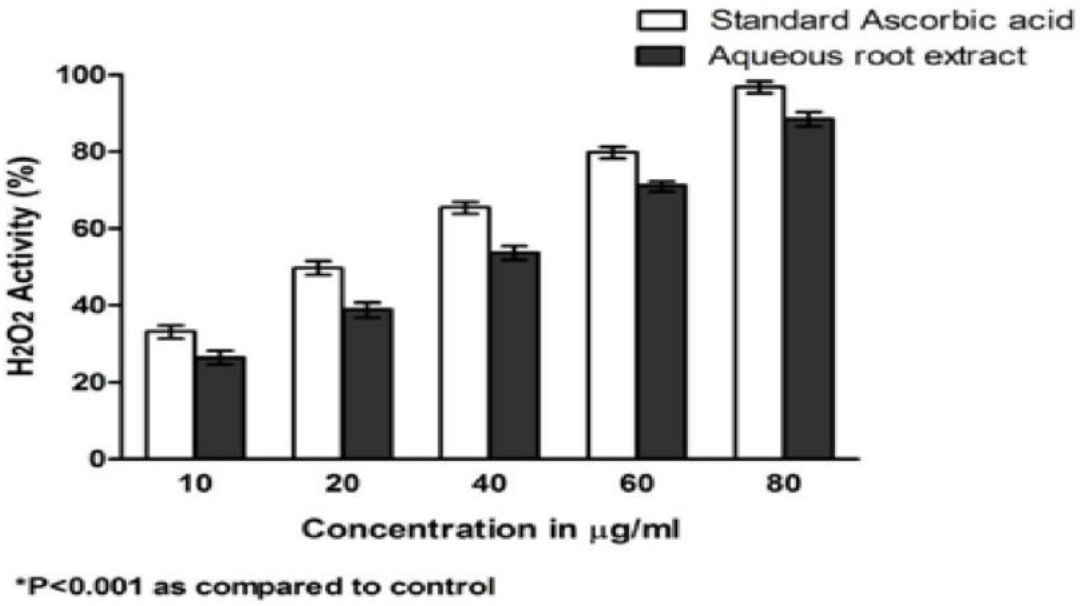
Figure-1: Percentage DPPH scavenging activity of AREZJ and ascorbic acid (standard).



*P<0.001 as compared to control

Hydrogen Peroxide scavenging activity. In H2O2 scavenging assay AREZJ showed 88.5 % free radical scavenging activity at 80 g/ml concentration whereas 96.8 % scavenging activity was observed with ascorbic acid at same conc. A dose dependent H2O2 reduction activity was observed with AREZJ which is shown in Figure-2.

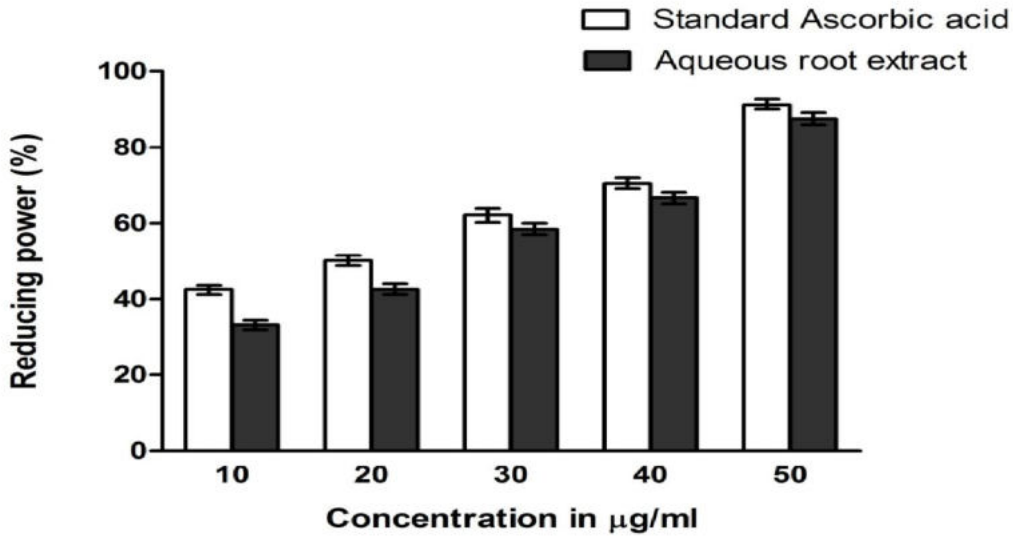
Figure-2: Percentage H_2O_2 scavenging activity of AREZJ and ascorbic acid (standard).



*P<0.001 as compared to control

Reducing Power. AREZJ showed promising reducing power of 87.5% at a concentration of 50µg/ml whereas 92.7% activity was observed with ascorbic acid at same concentration. Results are shown in Figure-3.

Figure-3: Percentage Reducing Power of AREZJ and ascorbic acid (standard).



*P<0.001 as compared to control

Preliminary Phytochemical Screening. AREZJ showed positive test for various natural groups viz. Alkaloids, Carbohydrates, Flavonoids, Glycosides, Proteins and Tannin (Table-4).

Table-4: Phytochemical analysis of AREZJ

S.no	Name of Photochemicals	Presence
1	Alkaloids	+
2	Anthraquinones	-
3	Carbohydrates	+
4	Flavonoids	+
5	Glycosides	+
6	Proteins	+
7	Tannins	+
8	Terpenoids	-

Discussion

Gastric ulcer is a break in the tissue lining of the stomach. Most ulcers can be cured without complications; however, in some cases peptic ulcers can develop, such as in penetration, perforation, bleeding (hemorrhage), and obstruction. Ethanol and aspirin-induced gastric ulcer models have been widely used for the evaluation of gastroprotective activity [25]. The present study reveals that plants root extract is safe as shown by oral toxicity study. The root extract protected the stomach against ethanol necrotic damage and its effect was comparable to omeprazole, an antiulcer agent. Similar finding were reported by Alam Bayan et. al. [26] in roots extract of Acacia catechu. AREZJ significantly ($P < 0.01$) reduced the ulcer index in ethanol and aspirin-induced ulcer models. The protection from ulcer formation was not dose dependent in aspirin induced ulcer model because 73.08% protection was observed with lower dose of 150 mg/kg b.wt while only 76.92% of protection was observed with higher dose of 250 mg/kg b.wt while in ethanol induced ulcer model the extract showed dose dependent protection, it was 36.68% with 150 mg/kg b.wt whereas 70% with 250mg/kg bwt.

It has been found that oxygen-derived free radicals are implicated in the mechanism of acute and chronic ulceration in the gastric mucosa [27]. In our in-vitro antioxidants study we have demonstrated that AREZJ have remarkable free radical scavenging activity. AREZJ scavenges 89.2 % DPPH free radical at 200 g/ml and 88.5 % H_2O_2 free radicals at 80 g/ml. Scavenging these free radicals may be playing an appreciable role in healing of ulcers [28]. AREZJ also presented significant reducing power (87.5% at 50 g/ml) which may be playing role in reducing superoxides, peroxides and glutathione.

Our phytochemical study reveals the presence of proteins, carbohydrate, tannins, alkaloids, glycoside and flavonoids. These phytoconstituents may be directly contributing to free-radical scavenging activity or by inducing antioxidant enzymes levels. However, until specific constituents are identified and characterized, exact mechanism for ulcer healing and antioxidants potential cannot be ascertained. Therefore these studies present a scientific basis which confirms folkloric claims of the beneficial uses of Zizyphus jujuba Mill.

Conclusion

We conclude that aqueous extract of Zizyphus jujuba Mill. has been found to have antiulcerogenic effect, which could be related to its antioxidant potential. More work is required for a clear understanding of the mechanism of action with chemically identified active principle.

Aknowledgements

Authors are grateful to G. Pandurangareddy, Chairman, Sree Datta Group of Institutions, Hyderabad for providing financial assistance and facilities. We thank Prof. P.V. Prasanna of Botanical Survey of India, Hyderabad, AP (India) for plant identification.

Declaration of Interest

The authors report no declarations of interest.

References

[1]. Peng WH, Hsieh MT, Lee YS, Lee YC, Liao J. Anxiolytic effect of seed of *Ziziphus jujuba* in mouse models of anxiety. J. Ethnophar. 2000; 72: 435-441.

[2]. Lee S, Min B, Lee C, Kim K, Kho Y. Cytotoxic triterpenoids from the fruits of *Zizyphus jujuba*. Planta Medica. 2003; 69: 18-21.

[3]. Taraneh E, Asna U. Antioxidant components and activity in the peel of *Ziziphus jujuba* Mill. J. Pharm. Reser. 2012; 5: 2705-2709.

[4]. Kumar S, Ganachari MS, Banappa, Nagoor VS. Antiinflammatory activity of *Ziziphus jujuba* Lam leaves extract in rats. J. Natu. Remed. 2004; 4(2): 183-185

[5]. Ganachari MS, Shiv K, Bhat KC. Effect of *Ziziphus jujube* leaves extract on phagocytosis by human neutrophils. J.Natu. Remed. 2004; 41: 47-51.

[6]. Ganachari MS, Shiv K, Bhat KCEffect of *Ziziphus jujube* leaves extract on phagocytosis by human neutrophils. J. Natu. Remed. 2004; 41: 47-51.

[7]. Ganachari MS, Kumar S. Anti-ulcer properties of *Ziziphus jujuba* Lam leaves extract in rats. J. Natu. Remed. 2004; 4: 103-08.

[8]. Ganachari MS, Kumar S, Alagawadi KR. Antiobese activity of *Ziziphus jujuba* Lam leaves extract in dietary obese rats. J. Natu. Remed. 2007; 7: 102-108.

[9]. Gupta RB, Sharma S, Sharma JR, Goyal R. Study on the physico-chemical characters of fruits of some wild and cultivated forms/spp. (Zizpi hus spp.). Haryana J Horticul sci. 2004; 33(3/4): 167-69.

[10]. Mishra KK, Kashyap P, Sawarkar HA, Mule BP, Verma SK, Kumar S. Evaluation of Antifungal Activity of Stones of *Ziziphus jujuba* for Ringworm infection. Inter. J. Her. Drug Rese. 2012; 1(3): 8-11.

[11]. Shirdel Z, Madani H , Mirbadalzadeh R. Investigation into the hypoglycemic effect of hydroalcoholic extract of *Ziziphus Jujuba* Leaves on blood glucose and lipids in Alloxan-Induced diabetes in rats. Iran J. Diabe. Lip. Disord. 2009; 13-19.

[12]. Kumar CS, Arutla R, Swaroopa D, Rao KS. Wound healing potential of *Ziziphus jujube* bark extract on albino rats. Inter. J. reser. Ayur. Pharm. 2012; 3(6).

[13]. Suerbaum S, Michetti P. *Helicobacter pylori* infection. N. Engl. J. Med. 2002; 347: 1175- 86.

[14]. Hoogerwerf WA, Pasricha PJ. Pharmacotherapy of Gastric Acidity, Peptic Ulcers and Gastroesophageal Relux Disease. In: Brunton L, Lazo J, Parker K, editor. Goodman & Gilman's: The Pharmacological Basis of Therapeutics. 11th ed. New York: McGraw-Hill Professional.; 2006. p. 972.

[15]. Tripathi KD. Essentials of Medical Pharmacology. 6th ed. New Delhi, India: Jaypee Brothers Medical Publishers.; 2008.

[16]. Berardi RR, Welage SL. Peptic Ulcer Disease. In: Dipiro JT, Talbert RL, Yees GC, Matzke GR, Wells GB, Posey ML,editor. Pharmacotherapy: A Pathophysiologic Approach. 6th ed. New York: McGrawHill.; 2005. p. 632-48.

[17]. Atta AH, Nasr SM, Moumeir SM. Antiulcerogenic effect of some plant extracts. Natu.l Pro. Radia. 2005; 4(4) July-Aug(article).

[18]. Gohar AA, Zaki AA. Assessment of some Herbal Drugs for Prophylaxis of Peptic Ulcer. Iran. J. Pharm. Res. 2014; 13(3): 1081-1086.

[19]. Verma VK, Sing N, Saxena P, Sing R. Anti-Ulcer and Antioxidant Activity of *Moringa Oleifera* (Lam) Leaves against Aspirin and Ethanol Induced Gastric Ulcer in Rats. Int. Res. J. ofPharmace. 2012; 2(2): 46-57

[20]. Dharmani P, Mishra PK, Maurya R, Chauhan VS, Palit G. *Desmodium gangeticum*:apotent anti-ulcer agent. Ind. J. Exp. Biol. 2005; 43:517-521.

[21]. Molyneux P. The use of the stable free redical diphenylpicrylhydrazyl(DPPH) for estimating antioxidant activity. Songkl. J. Sci. Technol. 2004; 26: 211-219.

[22]. Elizabeth K, Rao MNA. Oxygen radical scavenging activity of Curcumin. Intern. J. Pherma. 1990; 58:237-40.

[23]. Shreejayan, Rao MNA. Nitric oxide scavenging by curcuminoids. J. Pharm. Pharmacol.1997; 49:105-07.

[24]. Harbone JP. Phytochemical methods: A guide to modern technique of plant Analysis, 1st ed. London: Chapmann and Hall Ltd.; 1973.

[25]. Chang FK, Leung WK. Peptic ulcer disease. Lancet. 2002; 360: 933-41.

[26]. Alambayan J, Vats M, Sardana S, Sehrawat R. Evaluation of antiulcer activity of roots of *Acacia catechu* Willd. (Mimosoideae). J. Pharmaco. Phytoche. 2015; 3(5): 79-84.

[27]. Sannomiya M, Foneca VB, Dasilva MA et al. Flavonoids and antiulcerogenic activity from *Brysonima crassa* leaves extract. J Ethnopharm. 2005; 97: 1-6.

[28]. Umamaheshwari M, Asokkumar K, Rathidevi R et al. Antiuler and in vitro antioxidantactivities of *Jasminum grandiflorum* L. J. Ethnopharmacol. 2007; 110: 464-70.