

## MEDICINAL PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES OF KESUM (*POLYGONUM MINUS* LINN.): A MINI REVIEW

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### ABSTRACT

*Polygonum minus* Linn. (Polygonaceae) locally called as 'kesum' in Malay, is an important foodstuff in many Malaysian dishes, and have long been used in folk medicine to treat digestive disorders, dandruff and in perfume industry. This review discusses the current knowledge of chemical constituents, biological and pharmacological properties of *Polygonum minus* which will be presented and previously evaluated. The close relationship between traditional and modern sources for ethnopharmacological uses of *Polygonum minus*, especially for treatment against ulcer, hepatic abnormalities, genotoxicity, cytotoxicity and protozoa infections, due to the remarkable biological activity of *Polygonum minus* its will be appropriate to develop them as a biological based medicine. In this review is an up-to-date and comprehensive analysis of the phytochemistry, pharmacology and traditional uses of *Polygonum minus* will be presented.

**Keywords:** *Polygonum minus*, Photochemistry, Pharmacology, Biological activities.

### INTRODUCTION

The worldwide nearly 80% population depends on traditional medicines for primary health problems. Most of the researchers focused to investigate various traditional medicines for their scientific value [1]. Especially Polygonaceae family has several medicinal plants, for example, *Fallopia japonica*, *Fagopyrum tataricum*, *Rheum palmatum*, *Rheum officinale*, *Rumex acetosa*, *Fagop disyrum cymosum*, *Polygonum multiflorum*, *Polygonum aviculare*, *Polygonum bistorta*, *Polygonum cuspidatum*, and *Polygonum orientale*.

*Polygonum minus* Linn., is widely distributed in Europe and Southeast Asia such as Malaysia, Thailand, Vietnam and Indonesia. *Polygonum minus* is commonly known as knotweed in English and Jarak Belanda, Kesum, Kunyit Jawa, and Kelima Paya dan Cenohom in Malaysian language [2]. It is widely available on the damp areas of

the ditches, lakes and riverbanks. It survives well on cool and hilly areas [3]. This plant is described as shrubby, lanky and creepy and grows up to 1.0 m on the lowlands and 1.5 m height on cool and hilly areas. The leaves of the plant are long and lanceolate measuring about 5-7 cm in length and 0.5-2.0 cm in width. These are very aromatic with dark green and arranged alternatively, the stem is cylindrical, green and slightly reddish having short internodes with nodes that are easily rooted [3]. The small white purple-colored flowers are found at the end of the shoot [4]. This whole plant is used as foodstuff in many Malaysian dishes and also commonly used as a cure for digestive disorders, dandruff and aromatherapy in folk medicine [5]. Various studies reported the medicinal benefits of this plant. Hence, this review article is an up-to-date knowledge that covers its traditional medicinal uses, phytochemistry, and pharmacology and biological properties.

Table 1: Ethnopharmacomedicinally important species of polygonaceae

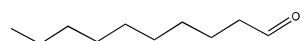
S. No.	Names	Common names	Ethno medical uses	References
1	<i>Fallopia japonica</i>	Japanese knotweed	Inflammatory and diabetes	[6]
2	<i>Fagopyrum tataricum</i>	Buckwheat	Diabetes, hepatic disorder and insulin resistance	[7,8,9,10]
3	<i>Rheum palmatum</i>	Turkey rhubarb	Antiviral, antiepileptic, hepatic steatosis, hyperlipidemia, hepatoprotective, diuretic, diabetes, nephropathy, chronic renal failure, ulcers, pancreatitis, inflammatory and toothache	[11-15]
4	<i>Rheum officinale</i>	Chinese rhubarb	Renal function disorders, hypolipidemia and cancer	[15]
5	<i>Rumex acetosa</i>	Sheep's sorrel	Antiproliferative, antioxidant, antiviral, antimutagenic and antigenotoxic	[16-19]
6	<i>Fagopyrum cymosum</i>	Perennial Buckwheat	Protective of lung injury and cancer	[20, 21]
7	<i>Polygonum multiflorum</i>	Black haired Mr. He	Antiaging, antiapoptotic, antineurotoxicity, antihepatic cancer, cholestasis, breast cancer, hair growth, antioxidant, Alzheimer's disease, Parkinson's disease and vascular dementia	[22-29]
8	<i>Polygonum aviculare</i>	Knotgrass	Reduce motility of sperm, cancer, antioxidant and antifibrotic	[30-33]
9	<i>Polygonum bistorta</i>	Knotweed, bistort and snakeroot	Antimicrobial, cancer and inflammatory	[34-36]
10	<i>Polygonum cuspidatum</i>	Japanese knotweed	Amenorrhea, arthralgia, jaundice, abscess, scald bruises, hepatoprotective agent, anti-inflammatory, wound healing, antifungal activity, urinary diseases, Parkinson's disease, antioxidant, free radical scavenger, antiapoptotic, oral cancer, neuroprotective, hypolipidemic agent and estrogenic activity	[37-47]
11	<i>Polygonum hydropiper</i>	Water-pepper	Inflammatory and antimicrobial activity	[48-49]
12	<i>Polygonum orientale</i>	Prince's Feather	Antioxidative stress and cardioprotective	[50-51]

## PHYTOCHEMISTRY

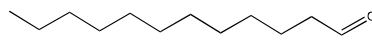
*Polygonum minus* is an aromatic plant and produces high levels of essential oil (72.54%) containing aliphatic aldehydes. It has been recognized by the Malaysian Govt in the Herbal Product Blueprint as an essential oil-producing crop [52,53]. It contains secondary metabolites such as flavonoids, aldehydes, terpenoids, geraniol, geranial and phenolic compounds [54]. Previous studies reported nearly fifty-three compounds, which were isolated from *Polygonum minus* leaves, and they are briefly described in Fig 1.

Decanal (1), dodecanal (2), decanol (3), 1-dodecanol, (4), undecanal (5), tetradecanal (6), 1-undecanol (7), nonanal (8), 1-nonanol (9),  $\beta$ -Caryophyllene (10), (Wasman et al. 2010) rutin (11), catechin (12), quercetin (13), isorhamnetin (14), hexanal (15), (Abdul

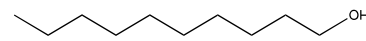
manaf 1996) 1-hexanol (16),  $\alpha$ -Pinene (17), kaempferol (18), undecane (19), nonanal (20), 1-nonanol (21), isobornyl acetate (22), n-decanoic acid (23),  $\alpha$ -cubebene (24), xanthorrhizol (25), (E)-caryophyllene (26), trans- $\alpha$ -bergamotene (27),  $\alpha$ -bisabolol (28), farnesene (29),  $\beta$ -himachalene (30),  $\alpha$ -selinene (31), valencene (32),  $\delta$ -cadinine (33), alloaromadendrene (34),  $\alpha$ -curcumene (35), (-)- $\alpha$ -panasinsene (36), cis-lanceol (37), farnesol (38), humulene (39), nerolidol (40), dodecanoic acid (41),  $\beta$ -caryophyllene oxide (42), trans- $\alpha$ -(Z)-Bergamotol (43), tetradecanal (44), alloaromadendrene oxide-(1) (45), trans-longipinocarveol (46), neoisolongifolene, 8-bromo- (47) isocaryophyllene (48), drimenol (49), drimenin (50), phytol, 6,7-methylenedioxy-5,3",4",5" tetramethoxyflavone (52), 7-4",5"-dimethylenedioxy-3,5,3"-trimethoxyflavone (53) [55].



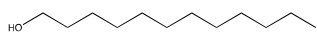
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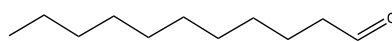
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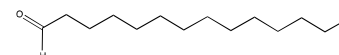
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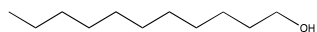
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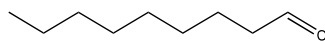
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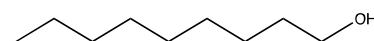
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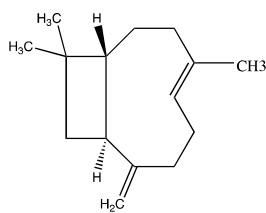
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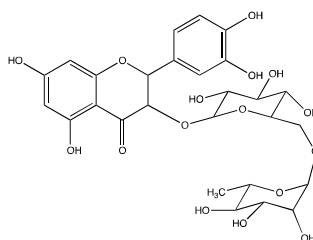
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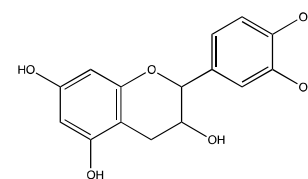
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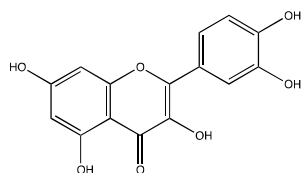
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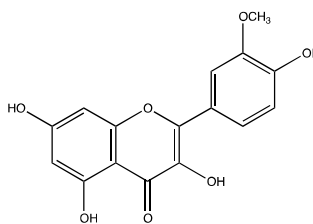
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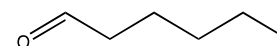
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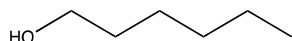
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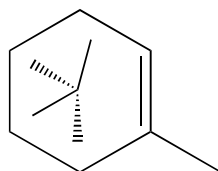
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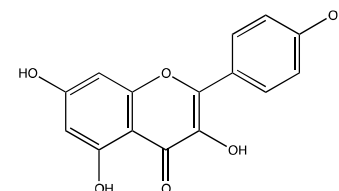
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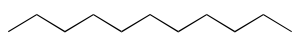
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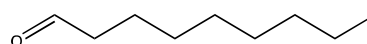
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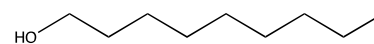
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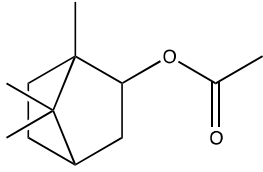
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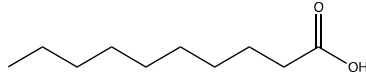
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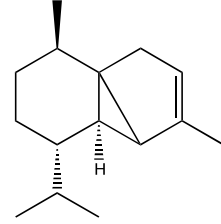
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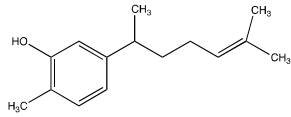
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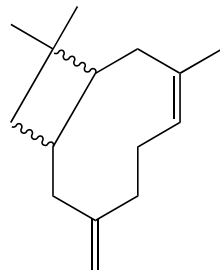
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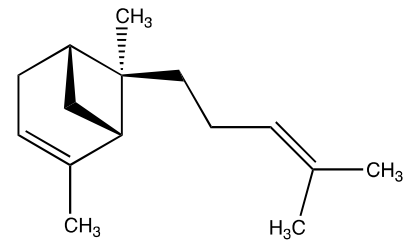
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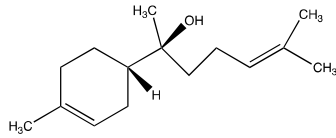
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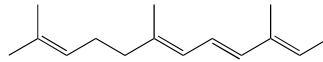
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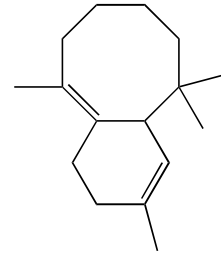
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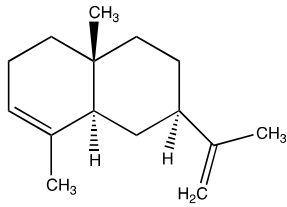
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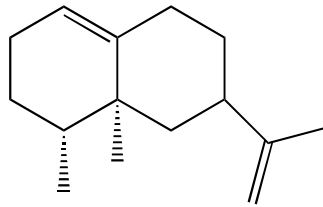
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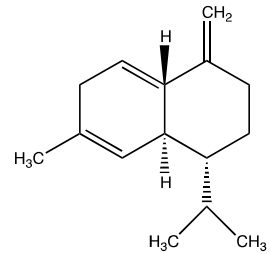
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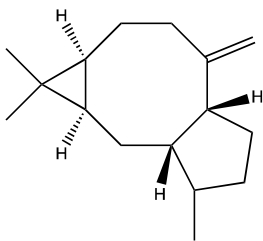
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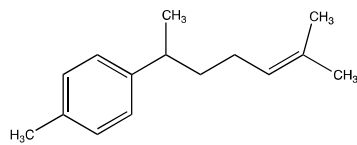
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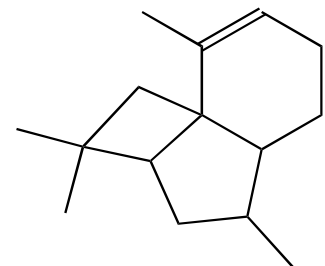
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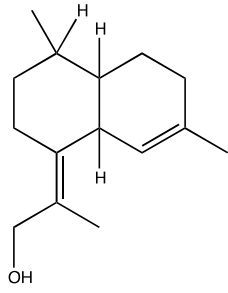
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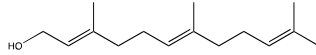
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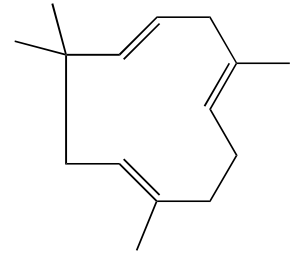
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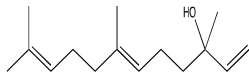
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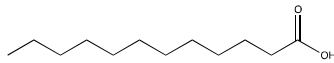
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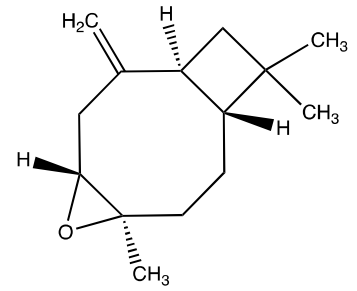
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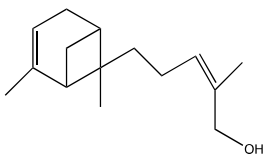
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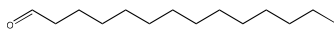
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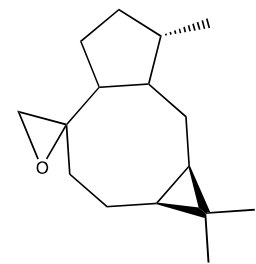
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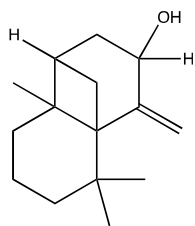
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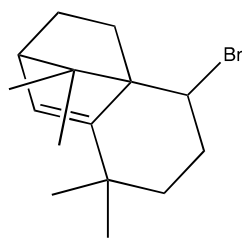
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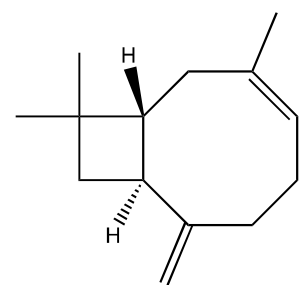
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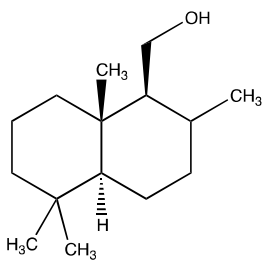
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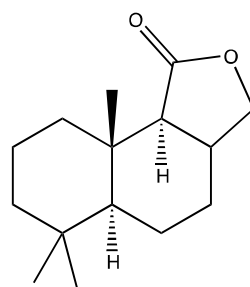
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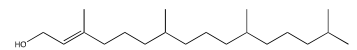
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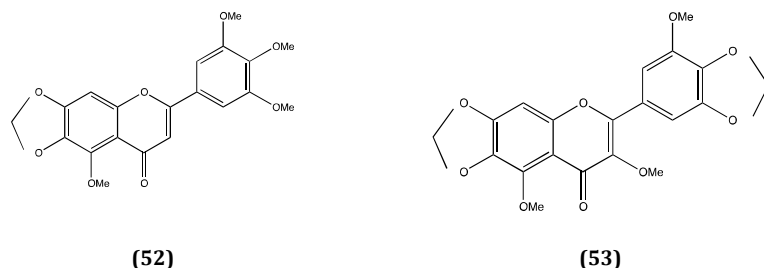


Fig. 1: Isolated different compounds from *Polygonum minus* leaves

## PHARMACOLOGICAL PROPERTIES

Researchers reported the different biological and pharmacological activities of *Polygonum minus* in both *in vitro* and *in vivo* experimental models. It has been found to exhibit antiulcer, antiviral, antifungal, antioxidant, anticarcinogenic and antigenotoxicity activities.

### Acute toxicity study

Aqueous extract of *Polygonum minus* exhibits no sign of hepatotoxicity, nephrotoxicity. It does not show any adverse influence on the food intake growth of organ weights, hematological parameters and mortality in experimental animals [55].

### Antiviral activity

Several studies on various Malaysian medicinal plants have been reported for antiviral activities [56, 57]. *Polygonum minus* is one of the important medicinal plants that possess antiviral activity against "vesicular stomatitis" (VSV) and "herpes simplex"-*jenis* 1 (HSV-1). Another study on *Polygonum minus* reported that the plant extract does not show any significant activity against ten isolated pathogenic fish bacteria [58]. A study on *Polygonum minus* against *Helicobacter pylori* showed potential activity when treated with various extracts such as petroleum ether, methanol and chloroform extracts [59]. Additionally, it has been evidently confirmed that *Polygonum minus* was slightly more effective than control substances in preventing microbial growth in refrigerated duck meatballs [60].

### Antifungal activity

A study reported that *Polygonum minus* showed potential activity against plant pathogenic fungi such as *Colletotrichum gloeosporioides*, *Colletotrichum capsici*. The study revealed that the methanolic extract showed significant activity when compared to the acetone and chloroform extracts [61]. *Polygonum minus* in combination with kerosene is prepared as a paste like substance and used for to treat fungal infections [62].

### Antiulcer activity

A recent study on the antiulcer activity on the aqueous extract of *Polygonum minus* has been reported the potential inhibitory activity against ethanol induced ulcers. [55]. Wasman et al., [2] reported that ethanolic extract of *Polygonum minus* abridged the ulcer area potentially when compared to the carboxymethyl cellulose negative control group rats. The methanol: ethyl acetate fraction with the ratio 1:1 is reported as the most outstanding fraction for gastro protective activity against oxidative stress caused by ethanol induction model.

### Antioxidant activity

Several studies showed the antioxidant activity of *Polygonum minus* which advances the high levels of free radical scavenging activity and reducing power using different extracts. Aqueous extract of *Polygonum minus* has been reported to have significant antioxidant properties [60, 63]. In the same manner, the ethanol extract of *Polygonum minus* also reported that the ethanol extract

showed potential antioxidant activity when compared to the aqueous extract [64, 65]. It has been evidently shown that various solvents involve in the quantity of antioxidant [65]. Numerous methods have been used to assess the antioxidant activity of *Polygonum minus* such as total phenolic compound (TPC), 2, 2-diphenyl-1-picrylhydrazyl free radical (DPPH) and ferric reducing antioxidant power (FRAP) [63, 66]. The presence of phenolic compounds in high quantity may be the reason for the high antioxidant of *Polygonum minus* [67,68].

### Cytotoxicity

A recent study on cytotoxicity of *Polygonum minus* against HeLa cells has been reported [69]. In addition, which has been calculated against normal lung fibroblast cell line Hs888Lu and the results did not present any inhibition percentage of cell viability in both ethanol and aqueous extract [64]. Wasman et al., [55] reported that the *Polygonum minus* leaf aqueous extract was able to shield gastric mucosa from ethanol-induced ulcer.

### Genotoxicity

Wan-Ibrahim et al., [70] evaluated twenty Malaysian medicinal plants involving *Polygonum minus* for antioxidant activity and genotoxic effects on human lymphocytes and they proved that aqueous extract of *Polygonum minus* is harmless.

## CONCLUSION

In the present review, we have analysed the relevant literature to congregate the phytochemical and pharmacological information on *Polygonum minus*. Based on the literature survey, *Polygonum minus* demonstrated various medicinal and pharmacological activities. However, details and careful analysis of the report data leads us to conclude that the plant only possessed promising antioxidant, antimicrobial, antifungal, cytoprotective and antiulcer activities. It is necessary to conduct more pharmacological studies at molecular level to investigate untapped potential of this plant. For these reasons, extensive pharmacological and chemical studies, together with human metabolism, will be focus for future studies. Now a days amplify in interest on herbal medicines accompanied by increased laboratory investigation into the pharmacological properties of the bioactive ingredients and their ability to treat various diseases has contributed to numerous drugs/herbal extract entering the international market.

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