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Review Article

Pharmacological and Medicinal Potential from Flowers of Perfume Tree *M. champaca* – A Review

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ABSTRACT

Michelia champaca L. belonging to the family *Magnoliaceae* is also called as Champak and has high medicinal applications. In general, plants are the rich source for providing potent drugs. Traditionally, the joy perfume tree was used in several treatments including fever, leprosy, cough, ulcer, abdominal cohlic, rheumatism, constipation, dysmenorrhoea, bronchitis, wounds, skin diseases and various other disorders. Also, this plant possesses numerous pharmacological properties such as anti-microbial, anti-pyretic, anti-inflammatory, anti-oxidant, insecticidal, anti-uretic, anti-dinic, carminative, anti-diabetic etc., Compounds namely flavanoids, alkaloids, sterols, saponins, triterpenoids, tannins were identified and characterized. Keeping in view of the above information, this comprehensive review focuses on to render the different activities, applications, and uses of *M. champaca*.

Keywords: *Michelia champaca*, anti-diabetes, anti-ulcer, anti-cancer, wound healing

INTRODUCTION

Michelia champaca is a large, handsome, evergreen tree with 12 genera and 220 species with the height up to 30m height and has golden yellow fragrant flowers and aggregate fruits[1,2]. They originate from the temperate Himalayan region and distributed throughout the countries like India, South China, and Indonesia[3]. *M. champaca* is a woody tree species, which has high economic value as basic material for medicinal and fragrance products[4]. The whole plant was traditionally used in the treatment of constipation, bronchitis, fever, abdominal colic, anti-diabetic, amenorrhea and rheumatism[5]. It is also claimed to possess various pharmacological properties such as anti-pyretic, anti-inflammatory, insecticidal and anti-microbial. The presence of various compounds such as alkaloids, flavanoids, saponins, tannins, sterols, triterpenoids etc. was identified from leaves, stem and root of this plant[6-9]. This ornamental tree is known by various names such as Champ, Champa, Champaka, *Champaca*, Champagam, Champakam, Champakamu, Champige, Chapa, Chempaka, Sampige, etc.

Flowers of this medicinal plant are white and yellow colored with short, auxiliary branchy blast, solitary and rarely in pairs, and 6-21 large tepals. These flowers contain a large number of stamens, short or elongated connective anthers; spirally arranged and stipitate gynoecium. Traditionally flowers were used in fever, leprosy, cohlic, eye disorders etc. Also it possesses activities such as leishmanicidal, insecticidal, anti-inflammatory, anti-microbial and anti-pyretic activities. It has been reported to have immune potential activity against various diseases[6,7]. This review is the compilation of medicinal, pharmacological and traditional uses of the flowers of the fragrant plant *M. champaca*. Various types of phytochemical compounds identified for its presence or absence in this flower extract is summarized in table 1.

Anti-microbial activity

Methanolic extract of *M. champaca* flower was prepared using soxhlet apparatus and tested for its anti-microbial activity against bacterial isolates. The results showed that *M. champaca* flower extract at 7.8 mg/L concentration controlled the population of bacteria like *V. cholera*, *Flavobacterium* sp., *E. tarda*, *E. coli*, *P. aeruginosa*, whereas, *Salmonella sp.* and *V. parahaemolyticus* were controlled at 62.5 mg/L concentration. *Klebsiella* sp., *V. alginolyticus* and *A. hydrophila* did not show any growth at 15.6 mg/L concentration[8]. Anti-bacterial activity was also performed by Umadevi Parimi *et al*., in which hexane and ethyl acetate extracts were obtained by soxhlet extraction and tested against two species of gram-positive and two gram negative bacteria. Agar disc diffusion method was used for this anti-bacterial assay. Ethyl acetate extract of *M. champaca* showed the highest activity against *S. aureus, B. subtilis, S. typhi and S. dysentry* (zones of inhibition: 12, 12, 14 and 8 mm) which revealed that the flower extract can act as better anti-microbial agent[10].

Anti-oxidant activity

Lee *et al*., used methanolic extract from soxhlet to determine the anti-oxidant activity. The result showed that extracts of *M. champaca* flower could inhibit maximum concentration of 40% DPPH. Furthermore, this was supported by the finding of octadecadienoic acid, butanoic acid, oleic acid, camphorsulfonic acid, acetic acid, pimaric acid, phenol and benzoic acid in this plant, which is responsible for the anti-oxidant property[8]. Umadevi Parimi

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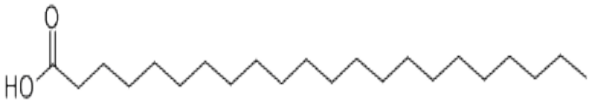

Figure 1: Structure of Gallic Acid

et al. isolated three major compounds from the crude hexane, ethyl acetate extracts (From the TLC fractionation two compounds using hexane and one from ethyl acetate extract have been isolated in their pure forms) from the flowers of *M.champaca*. The crude extracts and the three compounds were tested for the anti-oxidant property by scavenging DPPH free radical assay. The IC_{50} values calculated for the extracts of hexane, ethyl acetate and the three isolated compounds (1-3) were found to be 250 µg/mL, 160 µg/mL, 200 µg/mL, 220 µg/mL and 150 µg/mL, respectively. The activity of DPPH radical scavenging assay was found to be increasing with increasing concentration of the crude extracts and the compounds[10].

Anti-inflammatory activity

A study was carried out to determine the *in-vitro* anti-inflammatory property of *M. champaca* flowers using Human red blood cell membrane stabilization method (HRBC) and diclofenac sodium as reference drug. The flowers were finely powdered and extracted with methanol by Soxhlet method. The activity of membrane stabilization was increased with increase in the concentration of the extract, wherein the maximum membrane stabilization effect was observed at 300 µg/mL. At this concentration, the inhibitory activity of *M. champaca* flower extract and Diclofenac sodium was 57.4% and 60.60%, respectively. Therefore, this plant could be used in the treatment of inflammatory related disorders and diseases[12].

Anti-diabetic activity

Various solvents such as chloroform, petroleum ether, ethanol, acetone, and water were used for extraction of *M. champaca* flower buds. The flower extracts were obtained using Soxhlet extraction and the extracts were investigated for anti-diabetic activity. Animals were loaded with alloxan (120 mg/kg) to overnight fasted rats. Group I was left as normal, Group II received vehicle, Group III received Glibenclamide, Group IV & V received 200 & 400 mg/kg of ethanolic extract. The blood glucose level was determined as 81.40±3.22, 512.00±15.29, 124.40±7.84, 298.20±12.20, 320.00±14.40, respectively. Thus, the ethanolic extract of the flowers would be useful in the treatment of diabetes and related complications[1].

Hypolipidemic activity

Triton WR 1339 induced albino rats were used to study the hypolipidemic activity of *M. champaca* flower extract. The powdered flower was extracted with 70% methanol using Soxhlet apparatus. The animals were divided into 4 groups, where Group-I received standard pellet diet, water and 5% CMC (orally administered), group-II were treated with single dose of triton (350 mg/kg) intraperitoneally to induce hyperlipidemia, Group-III was administered a daily dose of methanolic flower extract 500 mg/kg suspended in 5% CMC after inducing hyperlipidemia and group-IV received the standard drug Atorvastatin at its hyperlipidemic stage and the study was conducted for 14 days. Administration of methanol extract of *M. champaca* flowers reduced the levels of low-density lipoproteins (LDL), very low-density lipoproteins (VLDL), serum cholesterol, triglyceride and increased high-density lipoproteins (HDL) level, similar to the standard drug. Potent hypolipidemic effect of methanolic extract was proved in Triton treated animals and hence *M. champaca* is more effective to manage hyperlipidemia[13].

Anti-ulcer activity

Aspirin induced rats were used to study the anti-ulcerogenic property of the alcoholic and aqueous extracts of *M. champaca* flowers. The flowers were dried, coarsely powdered and extracted with 95% ethanol in the soxhlet extractor. The animals of all group were given 200 mg/kg aspirin in 1% CMC for 5 days to induce the ulcer. Animals of group I received 0.9% of saline, group II received 50 mg/kg of Cimetidine, group III received 300 mg/kg of aqueous extract of flower and group IV received 300 mg/kg of alcoholic flower extract. The ulcer index was reduced as 0.6 and 1.2 in aqueous and alcoholic extracts of the flowers respectively, whereas saline treated group showed the value of 3.0. Thus, it was concluded that gastric secretion was reduced in the extract treated groups of animals[14].

Anti-cancer activity

The flower extract of *M. champaca* was used to investigate the anti-cancer property through MTT (3-(4, 5-dimethythiazol-2-yl) - 2, 5-diphenyl tetrazolium bromide) assay. The flowers were finely powdered and loaded into

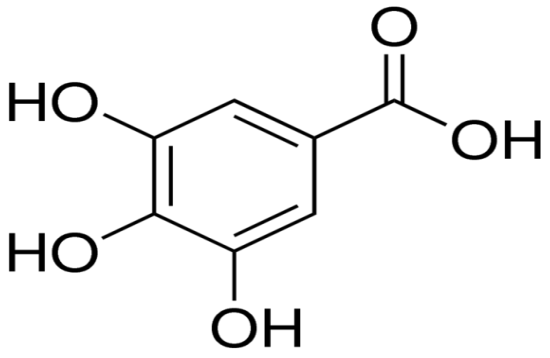

Figure 2: Structure of Quercetin isolated from *M. champaca*

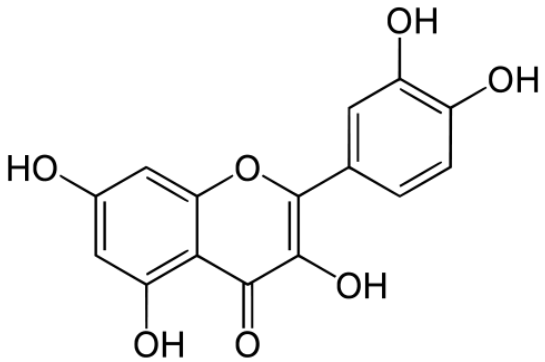

Figure 3: Structure of n-Docosanoic acid isolated from *M. champaca*

Table 1: The pharmacological activity of various parts of the whole plant *M. champaca*, and their extraction method is summarized in the following table.

S. No.	Part of the plant	Solvents used	Method of extraction	Activity	Compounds identified	References
1.	Flower bud	Petroleum ether, Chloroform, Acetone, Ethanol, Aqueous	Soxhlet	Anti-diabetic	-	[6]
2.	Flower	Methanol	Soxhlet	Hyperlipidemia	-	[13]
3.	Leaves	Methanol	Cold percolation	Anti-microbial Anti-oxidant Anti-cancer	9,12-octadecadienoic acid, methyl ester, E, E)- 2-Propanone, 1- phenoxy Benzofuran, 2,3-dihydro- 5,8,11,14-Eicosatetraenoic acid, methyl ester, (all-Z)- Butanoic acid, 2-methyl-3-oxo-, ethyl ester, 7- Oxabicyclo[4.1.0] heptanes, 1-methyl-4-(2-ethyloxiranyl)-7-Oxabicyclo [4.1.0] heptanes, 1-methyl-4-(2-methyloxiranyl)- Oleic acid Camphorsulfonic acid 3 unidentified compounds	[8]
4.	Leaves	Water	Hydro distillation using Clevenger type apparatus	Volatile oil composition	α-terpinolene, β-elemene, β-caryophyllene α –humulene, β-selinene, α-selinene γ-cadinene, (*E*)-nerolidol, α-cadinol β-bisabolol, (*Z*, *E*)-farnesol, pentadecanol hexadecanol	[9]
5.	Leaves	Methanol	Soxhlet Vs. Microwave	*In-vitro* Anti-oxidant Vs. DNA damage protection	-	[5]
6.	Leaves and stem bark	Methanol	Soxhlet	-	Gallic acid	[17]
7.	Leaves and stem bark	Methanol	Soxhlet	-	Quercetin	[18]
8.	Flower	Ethanol	Soxhlet	Burn wound healing	-	[16]
9.	Flower and leaf	Ethanol Aqueous	Maceration Soxhlet	Ulcer treatment	-	[14]
10.	Leaves	Hydro alcohol	Cold maceration	Arthritis	-	[1]
11.	Flowers	Methanol	Soxhlet	*In-vitro* anti-oxidant	-	[11]
12.	Stem bark	Ethanol	Soxhlet	-	3β-16α-dihydroxy-5-cholesten-21-al n-docosanoic acid Stigmasterol	[19]
13.	Stem bark	Petroleum ether	Soxhlet	Phytochemical studies	-	[2]
14.	Flower	Methanol	Soxhlet	Anti- inflammatory	-	[12]
15.	Flower	Ethanol	Soxhlet	Wound healing	-	[15]

Soxhlet extraction with 70% methanol. Human breast adenocarcinoma cells (MCF-7 cell lines) were grown in the standard cell medium (RPMI 1640) with 5% fetal bovine serum. The cells were treated with flower extract at the concentration of 7.8 to 62.5 mg/L and 10µL of 5 mg/mL MTT reagent was added to all the 96 wells of micro plate and incubated at 37°C for 4 h. At the maximum concentration, the IC50 was 1.86 ± 0.21µg/ml. Furthermore, anti-cancer property of *M. champaca* was convinced since several compounds responsible for the anti-cancer activity were identified in the extract[8].

Wound healing activity

The wound healing property of ethanolic extract of *M. champaca* flowers for its topical application was evaluated using Streptozotocin induced diabetes rats. The powdered flowers were loaded into Soxhlet extractor and extracted with 95% ethanol. Diabetes was induced as single dose of Streptozotocin solution at the concentration of 30 mg/kg in sodium citrate buffer. Animals were treated separately with ointment base and topical administration of the extract. Group I and II served as control animals with and without diabetes respectively and they received only ointment base. While the animals of other groups namely III, IV, V contains diabetic animals and they received flower extracts on increasing doses 2.5%, 5% and 10% w/v. The mean breaking strength was 259.28 ± 7.54 g and 234.56 ± 5.49 g in non-diabetic control and the diabetic control groups, respectively. An increased mean breaking strength of 276.22 ± 9.42 g was observed in the group of animals that received 2.5% of flower extract which was not significant. However, the mean breaking strength of 303.72 ± 9.7 g and 319 ± 9.23 g was demonstrated in the animals that received 5% and 10% of flower extracts. The non-diabetic control group showed wound contraction percentage as 19.32 ± 2.43, 44.82 ± 1.76, 62.71 ± 3.53 and 82.46 ± 2.43 as measured on day 4, 8, 12 and 16 respectively. But the percentage of wound contraction rate was significantly reduced in diabetic control animals as 32.06 ± 2.29, 46.2 ± 1.92 and 67.22 ± 5.41 on day 8, 12 and 16 respectively, without significant decrease on day 4. Thus *M. champaca* flower extract showed better wound contraction rate[15].

Burn wound healing activity

The period of epithelialization and wound contraction rate were the key parameters to study the burn wound healing activity in rats. The *M. champaca* flowers were powdered and loaded in Soxhlet extractor with 95% ethanol. Dexamethasone (0.17 mg/kg) was administered to make Dexamethasone suppressed burn model. Wound contraction rate was observed as 97.07 ± 2.74 and 95.82 ± 4.93 on the 16th day of topical and oral administration of *M. champaca* extract respectively. In the *dexamethasone* suppressed burn wound model, wound contraction rate was decreased as 88.24 ± 5.96 by oral dosage and increased as 95.40 ± 2.49 by topical application of extract on the day 16. Also oral dosage showed a significant decrease in the wound contraction rate on day 12. Period of epithelialization was reduced in the burn wound model as 18.00 ± 3.03 and 18.33 ± 2.42 for the oral and topical administration of *M. champaca* flower extract, respectively and 21±3.58 on topical administration of extract in the Dexamethasone suppressed burn wound. The result showed that epithelialization period of burn wound model was reduced both in oral and topical administration of flower extract, whereas it was delayed in Dexamethasone suppressed burn wound. Thus, *M. champaca* could be used in the treatment of burn wounds of immuno-compromised patients[16]. Various phytoconstituents such as Gallic acid, Quercetin, n-docosanoic acid have been identified and reported from various parts of *M. champaca*[17-19].

CONCLUSION

The findings justify the traditional uses of this plant in the treatment of diabetes, wounds, inflammatory conditions, worms, infestations and malarial fever. This review exposed that *Michelia champaca* is an important medicinal plant which is widely used in the field of medicine, pharmaceutical and food industries. Also, it is noticeable that further researches should be carried in this plant in terms of *in-vivo* experiments which could help the usage of this plant in the clinical application for mankind and thus helps in human welfare.

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