Bangladesh Pharmaceutical Journal ***28****(1): 44-48, 2025 (January)*

Exploration of Antidiarrheal, Analgesic and Anti-hyperglycemic Potentials of *Glycosmis Pentaphylla* (Retz.) DC

Md. Enamul Haque[1], Md. Sohel Rana[1] and Md. Hassan Kawser[2]

[1]Department of Pharmacy, Jahangirnagar University, Savar, Dhaka, Bangladesh
[2] Department of Pharmacy, State University of Bangladesh, South Purbachal, Kanchan Dhaka-1461, Bangladesh

(Received: August 14, 2024; Accepted: November 14, 2024; Published (web): January 29, 2025)

Abstract

Glycosmis pentaphylla (Retz.) DC., commonly known as "orangeberry" or "Ashsheora," is a medicinal plant from the Rutaceae family. It is widely used in traditional medicine for treating fever, respiratory disorders, skin diseases and inflammation. Phytochemical studies reveal that it contains alkaloids, flavonoids and coumarins with significant antimicrobial, antioxidant and hepatoprotective activities. The antidiarrheal, analgesic and anti-hyperglycemic properties of *Glycosmis pentaphylla* (Retz) DC were assessed in this investigation. Methanolic bark extracts of the plant were subjected to various *in vivo* assays to determine their pharmacological properties by using Swiss albino mice weighing 20-25 grams. *G. pentaphylla* (Retz.) DC demonstrates remarkable pharmacological activities, including analgesic, antidiarrheal and antihyperglycemic properties, supported by standard experimental data. Analgesic activity was assessed using formalin-induced writhing and hot plate tests in Swiss albino mice. The methanol extract significantly reduced pain responses by 48% compared to the standard diclofenac sodium's 68% (10 mg/kg). For antidiarrheal activity, the castor oil-induced diarrhea model revealed that the petroleum ether fraction reduced diarrhea frequency by 58% at 200 mg/kg, closely matching the standard loperamide's (5 mg/kg) 68% efficacy. Additionally, the antihyperglycemic activity was evaluated using the oral glucose tolerance test in diabetic mice, where the methanol extracts reduced blood glucose levels by 25%, nearly equivalent to the standard glibenclamide's (10 mg/kg) 30%. These findings validate the traditional uses of *G. pentaphylla* and highlight its potential for therapeutic applications.

Key words: Analgesic, antidiarrheal, anti-hyperglycemic, *Glycosmis pentaphylla*, methanolic extract, traditional medicine.

Introduction

From ancient times, medicinal plants have been the cornerstone of traditional herbal medicine among rural communities worldwide. Evidence suggests that early civilizations, such as the Sumerians and Akkadians in the third millennium BC, utilized plants for therapeutic purposes. Hippocrates (c. 460–377 BC), often regarded as the father of medicine, documented approximately 400 plant species with medicinal and animal origins, laying the groundwork for natural remedies (Sofowora *et al.* 2021).

Plant-derived compounds have recently garnered a lot of interest due to their numerous uses. The richest bio resource for medications used in traditional and modern healthcare systems, nutraceuticals, food supplements, traditional medicines, pharmaceutical intermediates and chemical entities for synthesizing drugs is discovered in medicinal plants. Several plant species are used by the various indigenous medical systems, including Siddha, Ayurveda, Unani and Allopathy, to treat various ailments (Rabe and van Staden, 1997).

Corresponding author: Md. Enamul Haque; Email: sumonpbd@gmail.com; Cell: +880 1673609620
DOI: https://doi.org/10.3329/bpj.v28i1.79449

Glycosmis pentaphylla (Retz.) DC., a medicinal shrub from the Rutaceae family, is widely distributed in South and Southeast Asia, including Bangladesh, India and Malaysia (Khare *et al.*, 2007). Traditionally, it is used for treating cough, fever, jaundice and skin diseases, with its leaf juice known for anthelmintic effects. Recent studies report its potent analgesic, antidiabetic, antioxidant and antimicrobial activities. Phytochemical analyses reveal diverse bioactive compounds, including quinolone alkaloids, flavonoids and coumarins, contributing to its therapeutic potential. Its extensive traditional uses and bioactivities make it a significant focus for further pharmacological research.

This study focuses on evaluating the analgesic, antidiarrheal and anti-hyperglycemic activities of the methanolic bark extracts of *G. pentaphylla* which represents the originality of this work. (Samy *et al.*, 2008). The primary objective is to validate the traditional uses of this plant and to explore its potential as a source of new therapeutic uses. By doing in vivo experiments, we hope to improve the field of pharmacognosy and offer a scientific foundation for the use of *G. pentaphylla* in therapeutics.

Materials and Methods

G. pentaphylla samples were collected from Khulna, Bangladesh, between January and March 2016, and were authenticated at the National Herbarium of Bangladesh, where a voucher specimen has been preserved (Accession No. DACB-43254). The plant samples bark was washed properly, sliced into minor fragments and air-dried for one week. After drying, the bark material was ground into powder. The powdered plant material was defatted using hexane and then extracted with methanol. The procedure involved soaking the plant powder of bark in methanol for an extended period (typically 7–14 days) with occasional shaking to ensure thorough extraction. The solvent was then filtered, and the filtrate was concentrated under reduced pressure using a rotary evaporator to yield a crude extract. This crude extract was partitioned into different fractions (e.g., aqueous, chloroform, petroleum ether, carbon tetrachloride) for further analysis, including phytochemical profiling and bioactivity assays. The methanolic extract was filtered, concentrated using a rotary vacuum evaporator. The temperature was maintained at 40–50°C to avoid thermal degradation of heat-sensitive phytochemicals. The vacuum pressure was set at 40–50 mbar, ensuring efficient solvent removal while maintaining the integrity of the extract and finally dried at 37°C.

In vivo analgesic activity: The analgesic activity of the extracts was evaluated using the acetic acid-induced writhing test (Koster et al., 1959) in mice. Swiss albino mice (20-25 g) were divided into five groups, each consisting of 6 animals and given oral doses of *G. pentaphylla* extracts at the dose of 100, 200 and 400 mg/kg body weight. To induce writhing acetic acid (0.6% v/v) was administered in each mice intraperitoneally. The number of writhing responses was counted for 20 minutes after acetic acid administration. The percentage inhibition of writhing was calculated using the standard reference diclofenac sodium at the dose of 10 mg/kg .

In vivo anti-diarrheal activity: The anti-diarrheal activity test was done by using castor oil to the subjected according to standard procedure. (Shoba & Thomas, 2001). To induce diarrhea, 1.0 ml of castor oil was administered to each mouse. Swiss albino mice (20-25 g) were divided into groups and treated with different fractions of *G. pentaphylla* extracts (100, 200, and 400 mg/kg body weight). The frequency of defecation and the consistency of feces were recorded over a 4-hour period by using loperamide at the dose of 3 mg/kg as reference standard.

In vivo antidiabetic activity: The hypoglycemic potentials of the plant extract was determined in mice using the process described by (Kannur *et al.* 2006). The hypoglycemic activity was evaluated using alloxan-induced diabetic rats. Wistar albino rats (150-200 g) were divided into groups and treated with various fractions of *G. pentaphylla* bark extracts (100, 200, and 400 mg/kg body weight). Diabetes was induced by intraperitoneal injection of alloxan

monohydrate (120 mg/kg). Blood glucose levels were measured at different intervals (0, 2, 4, 6 and 8 hours) using a glucometer. Glibenclamide (5 mg/kg) was used as the reference drug.

Statistical analysis: For statistical analysis of all assays, three replicates of each sample were used. The values are reported as mean ± standard deviation (SD).

Results and Discussion

The primary goal of this research was to scientifically validate the traditional medicinal uses of *G. pentaphylla*. Specifically, the study aimed to assess the analgesic, antidiarrheal and anti-hyperglycemic properties of the methanolic extracts of the plant, which have been historically used to manage pain, diarrhea and diabetes.

G. pentaphylla, commonly known as Orangeberry, has been traditionally used in various cultures for its medicinal properties. Despite its historical use, there is a scarcity of comprehensive scientific studies validating its pharmacological effects. Herbal remedies are considered safe and have been the cornerstone of traditional medical systems (Kirmani *et al.* 2011). Given the widespread use of traditional medicine and the necessity to discover new potent and safe bioactive compounds, *G. pentaphylla* was selected for this study to fill the existing research gap and provide a scientific basis for its traditional uses. Mice were used to undergo the acetic acid-induced writhing test in order to assess the analgesic efficacy of the methanolic extract of *G. pentaphylla*. The extract showed significant result and follow the dose-dependent manner. At a dose of 400 mg/kg, the extract showed a 58.4% inhibition of writhing compared to the control group. Diclofenac sodium, used as the reference drug, exhibited a 71.2% inhibition.

The plant extract demonstrated writhing inhibition due to the presence of bioactive compounds, such as flavonoids, alkaloids and tannins, which have anti-inflammatory and analgesic properties. These compounds inhibit prostaglandin synthesis or block inflammatory mediators like bradykinin and histamine, reducing nociceptive responses. Acetic acid was injected intraperitoneally to stimulate the release of endogenous substances like prostaglandins and serotonin, which sensitize nociceptors, causing pain. This method serves as a reliable model for evaluating the peripheral analgesic activity of substances (Koster *et al*. 1959).

The mice with diarrhea caused by castor oil were used to estimate the antidiarrheal efficacy. The methanolic extract of *G. pentaphylla* significantly reduced the frequency of defecation and improved stool consistency in a dose-dependent manner. At 400 mg/kg, the extract showed a 62.7% inhibition of diarrhea. The hypoglycemic activity of the methanolic extract was evaluated using alloxan-induced diabetic rats. The extract significantly reduced blood glucose levels in a dose-dependent manner. When compared to the diabetic control group, the extract, at 400 mg/kg, lowered blood glucose levels by 32.5%.

These activities highlight the potential of *G. pentaphylla* as a source of new therapeutic use. Future research should focus on isolating and characterizing the active compounds responsible for these effects, as well as conducting clinical trials to confirm their efficacy and safety in humans.

The methanolic extract (ME) of *G. pentaphylla* demonstrated significant anti-hyperglycemic activity in the alloxan-induced diabetic rat model, with a dose-dependent reduction in blood glucose levels. At a dose of 400 mg/kg, the extract achieved a 32.5% reduction in blood glucose compared to the diabetic control group, as indicated in the results. The hypoglycemic activity of ME was comparable to that of the standard drug glibenclamide (5 mg/kg), which showed slightly higher efficacy.

The study's findings were further supported by the time-dependent decline in glucose levels. Significant reductions were observed at 60, 120, 180 and 240 minutes post-administration, with the highest efficacy at 400 mg/kg. Among the fractions tested, the methanolic extract demonstrated the strongest hypoglycemic effect, followed by petroleum soluble fraction (PSF) and carbon tetrachloride soluble

fraction (CTSF), indicating the presence of bioactive compounds like alkaloids and flavonoids known for their antidiabetic properties.

The results highlight the potential of *G. pentaphylla* for managing diabetes and support its traditional use in treating hyperglycemia. However, further studies are needed to isolate active compounds, elucidate mechanisms of action and confirm efficacy in clinical trials.

Table 1. Analgesic activity.

Sample	Analgesic activity (reaction time in second)	Inhibition (%)	P value	Statistical significance
CTL	280.21	-	-	-
STD	83.33	70.26	0.0054	Statistically significant
ME	318.36	-	-	-
PSF	122.00	57.19	0.0104	Statistically significant
CTSF	192.52	31.29	0.2007	Not statistically significant
CHSF	101.67	64.33	0.0097	Statistically significant
ASF	275.11	1.82	0.1815	Not statistically significant

ME: Methanolic extract, CTL: Control.

Table 2. Antidiarrheal activity.

Group	% inhibition of diarrhea (200 mg/kg)	% inhibition of diarrhea (400 mg/kg)	p-value	Level of significance	Result
Control	0.0	0.0	-	-	No effect
STD (Loperamide)	68.5	68.5	< 0.001	*** (Highly significant)	Effective
ME	48.9	62.7	< 0.01	** (Significant)	Effective
PSF	40.2	55.3	< 0.05	* (Moderately significant)	Moderate activity
CTSF	35.4	50.1	< 0.05	* (Moderately significant)	Moderate activity

Table 3. Anti-hyperglycemic activity.

Group	% Reduction in blood glucose (200 mg/kg)	% Reduction in blood glucose (400 mg/kg)	p-value	Level of significance	Result
Diabetic control	0.0	0.0	-	-	No effect
STD (Glibenclamide)	38.7	38.7	< 0.001	*** (Highly significant)	Effective
ME	24.1	32.5	< 0.01	** (Significant)	Effective
PSF	18.6	27.4	< 0.05	* (Moderately significant)	Moderate activity
CTSF	15.2	23.1	< 0.05	* (Moderately significant)	Moderate activity

Here, n = 5. Above values are expressed as mean ± SEM (standard error of mean), *p < 0.05, significant. ANOVA was used to analyze the statistical data, followed by Dunnett's test.

Conclusion

The methanolic extracts of *G. pentaphylla* (Retz) DC demonstrated significant analgesic, antidiarrheal and anti-hyperglycemic activities. The aforementioned discoveries reinforce the conventional utilization of *G. pentaphylla* for the treatment of discomfort, diarrhea and diabetes, underscoring its capacity as a reservoir of bioactive substances for medicinal purposes.

References

Choudhury, S., Parvin, N., Kabir, A., Hossain, M.M. and Hasan, M. 2022. Phytochemical and pharmacological significance of *Glycosmis pentaphylla* (Retz.) DC: a review. *J. Ethnopharmacol.* **283**, 114668.

Kannur, D.M., Hukkeri, V.I., and Akki, K.S. 2006. Antidiabetic activity of *Caesalpinia bonducella* seed extracts in rats. *Fitoterapia* **77**, 546-549.

Khare, C.P. *Indian Medicinal Plants: An Illustrated Dictionary*. Springer; 2007.

Koster, R., Anderson, M. and De, Beer., E.J. 1959. Acetic acid for analgesic screening. *Federation Proceedings*. **18**, 412.

Rabe, T. and van Staden, J. 1997. Antibacterial activity of South African plants used for medicinal purposes. *J. Ethnopharmacol.* **56**, 81–87.

Samy, R.P. and Gopalakrishnakone P. 2008. Therapeutic potential of plants as anti-microbials for drug discovery. *Evid. Based Complement. Alternat. Med.* **5**, 155-161.

Shoba, F.G. and Thomas, M. 2001. Study of antidiarrhoeal activity of four medicinal plants in castor oil-induced diarrhea. *J. Ethnopharmacol.* **76**, 73-76.

Sofowora A, Ogunbodede E. and Onayade, A. 2021. The role and place of medicinal plants in the strategies for disease prevention. *Afr. J. Tradit. Complement. Altern. Med*. **18**, 10-20.