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Antitussive Effect of Aerial Parts of *Caesalpinia Pulcherrima* L. by Sulfur Dioxide Induced Cough in Rats

Syed Muhammad Umer Gilani*, Rifat Roshan, Salman Ahemd, Muhammad Mohtasheem Hasan

Department of Pharmacognosy, Faculty of Pharmacy and Pharmaceutical Sciences, University of Karachi, Karachi-75270, Pakistan.

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****Address of Correspondence Author:*** *drumergilani4@gmail.com*

ABSTRACT

Study objectives: The aim of the study was to evaluate antitussive effect of aerial parts of ethanolic extract of *Caesalpinia pulcherrima* (Caesalpiniaceae).

Methods: In this study cough was induced by the sulfur dioxide induction method. Four groups of animals were made with six animals in each group and all drugs were administered orally. Group I as control, group II as standard while groups III and IV received 200 and 400 mg/kg *Caesalpinia pulcherrima* aerial parts extract.

Results: Suppression of cough was observed by *Caesalpinia pulcherrima* aerial parts (CPAP) extract. Doses of 200 and 400 mg/kg *Caesalpinia pulcherrima* aerial parts extract showed highly significant results compared to standard at 60 and 90 min of drug administration.

Conclusion: From the above results it can be concluded that plant have significant activity of cough suppresstion.

Keywords: *Caesalpinia pulcherrima L., Caesalpiniaceae, Antitussive.*

INTRODUCTION

For thousands of years, natural products are playing a significant role in the treatment and prevention of diseases. According to the data collected by WHO, world's 80% population depends on traditional medicines for curing and preventing ailments [1]. Cough is the most common symptom of airways and lung disease [2]. It is considered as defensive response that provokes the clearance of secretion and protect against foreign materials, pathogens, noxious materials and lower respiratory tract infection [3]. For cough treatment usually expectorants, bronchodilators, mucolytics, antitussives and glucocorticoids are used. Several plants like *Chamaedorea tepejilote* are also used for treating respiratory disorders including cough, pleurisy, expectoration and pneumonia [4].

Caesalpinia pulcherrima L. is an ornamental plant usually 3.7-4.3 m in height, commonly known as Peacock flower and is used traditionally to treat cough, bronchitis and asthma [5]. Flowers, leaves and other parts are used for treating inflammation, otitis media, muscular and rheumatic pain. Many phytoconstituents like cassane diterpenoids, isovouacapenol C and pulcherrimin A in root, peltogynoids, bhonducellin, 6-methoxypulcherrimin and homoisoflavonoids in stem, lupeol, β-sitosterol, flavonoids, and myricetin in flowers, hydrocyanic acid, tannins and benzoic acid in leaves are reported [5,6]. *Caesalpinia pulcherrima* has shown numerous pharmacological activities like anti-diabetic [7] anti-inflammatory, analgesic [6,8] anticonvulsant [1] anti-arthritic [9] antifertility [10] anthelmintic [11] antimicrobial, antioxidant, cytotoxic [5,12,13] and antiulcer [14]. The aim of the study was to evaluate antitussive effect of aerial parts of ethanolic extract of *Caesalpinia pulcherrima* (Caesalpiniaceae).

METHODOLOGY

Plant material

Aerial parts of *Caesalpinia pulcherrima* were collected from University of Karachi, Karachi, Pakistan. Identification of plant was done by the Centre of Plant Conservation, Karachi University Herbarium and Botanic Garden, University of Karachi and given G.H. N0. 93481.

Preparation of extract

Aerial parts of the plant were cleaned, cut and soaked in ethanol for two days then filtered and the filtrate was concentrated under vacuum at 40ºC by a rotary evaporator. This ethanol extract was prepared for performing the antitussive activity.

Animals

Swiss albino rats of 150-180g were used in the study. They were kept under a normal day-night-cycle at 25±2ºC in polypropylene cages with food and water. The animals were grouped (N=06) randomly as control, standard and test groups. All procedures were followed according to ethical standards (IBC KU-211/2021) and international guidelines on animal experimentation.

Chemicals and drugs

1. Sodium hydrogen sulfite
2. Sulphuric acid
3. DMSO (Dimethyl sufoxide)
4. Standardized dry extract of ivy leaves

Antitussive activity

Approved protocol was followed for performing this activity by sulfur dioxide induction method described by Miyagoshi *et al*., 1986 was followed with some modifications. The extract was dissolved in DMSO to make the solution and animals were grouped as describe in Table **1**.

Statistical Analysis

Frequency of cough bouts was calculated and results expressed as mean values ± S.E.M. Value of P≤0.05 was considered as significant, P≤0.01 as very significant and P≤0.001 as highly significant as compared to control.

Table 1. Grouping of animals.

Group I	**Control**	**Distilled water**
Group II	Standard	Standardized dry extract of ivy leaves
Group III, IV	Experimental group	Ethanolic extract of CPAP at 200 and 400 mg/kg b.w

Table 2. Anti-tussive potential of ethanolic extract of CPAP by SO_2 induced cough method.

Groups	Treatment	Dose mg kg^{-1}	Cough frequency			
			0 minute	**30 minute**	**60 minute**	**90 minute**
Control	D/W	1	21.13±3.15	4.50±0.22	20.00±4.47	26.50±6.03
Standard	Ivy leaves extract	15	24.05±5.59	1.00±0.44*** (77.77%)	0.50±0.25*** (97.5%)	2.00±0.89*** (92.45%)
Test	CPAP	200	26.4±3.19	0.66±0.42*** (85.33%)	0.47±0.30*** (97.65%)	1.31±0.07*** (95.05%).
	CPAP	400	20.00±1.31	1.66±0.76** (63.11%)	0.33±0.21*** (98.35%)	1.66±1.05*** (93.73%)

Results were expressed as mean ± S.E.M (n=6) *P≤0.05 significant as compared to control, **P≤0.01 is very significant as compared to control. ***P≤0.001 is highly significant as compared to control.

RESULTS

The ethanolic extract of aerial parts of *Caesalpinia pulcherrima* showed no mortality and no changes in behavior of rats were observed. In this way it confirmed the safety profile of the plant. The effect of ethanolic extract of *Caesalpinia pulcherrima* aerial parts on SO_2 induced cough in rodents are represent in Table **2**.

The *Caesalpinia pulcherrima* aerial parts (CPAP) extract and standard drug showed antitussive activity. From the results, it was observed that maximum inhibition of cough was produced (97.65% and 98.35%) at 60 min of the experiment by both doses. The 200mg/kg ethanolic extract of CPAP has showed 85.33%, 97.65% and 95.05% at 30, 60 and 90 min while 400mg/kg of ethanolic extract of CPAP has produced 63.11%, 98.35% and 93.73% inhibition of cough at 30, 60 and 90 min. The percentages inhibition of cough of standard drug was 77.77%, 97.5%, 92.45% at 30, 60 and 90 min respectively.

DISCUSSION

Cough is a normal physiological response to any irritation produced in larynx and trachea and one of the common symptoms of asthma. By different methods, coughing is produced in animal models such as chemical irritation or mechanical and by electrical stimulation of tracheal mucosa but the most preferred methods are mechanical or chemical stimulation as it is similar to the physiological event. Sulfur dioxide induced cough method is usually followed for antitussive activity [16].

Antitussive drugs usually inhibit cough by two mechanisms either by centrally acting mechanism and peripheral acting mechanism. The centrally acting antitussive inhibits the cough pathways inside the CNS and these drugs are mostly used such as opioids, codeine and opiates. But these are associated with undesirable side effects of sedation, respiratory depression and gastrointestinal motility problems. The peripherally acting antitussive inhibits responsiveness of airway nerve subtype which elicits cough and these medicines are not used commonly. Various CNS acting antitussive are associated with serious side effects so there is a need for a better understanding of cough pathways to develop new peripheral acting antitussive [17,18].

Antitussive activity of *Caesalpinia pulcherrima* on the animal models showed significant antitussive effects like the standard drug thus it could be assumed that the effects might be attributed to the phytoconstituents present in the plant.

CONCLUSION

Many plants with antitussive activities have been reported based on their traditional use for relieving cough. Based on its use for cough, *Caesalpinia pulcherrima* was evaluated for antitussive activity. From the results obtained it can be concluded from this study that *Caesalpinia pulcherrima* is a useful medicinal plant and can able to suppress the cough by acting on the neuronal system in the medulla. Antitussive results also prove the traditional use of the plant. Diversification of research on *Caesalpinia pulcherrima* may lead discovery of new compounds for betterment of mankind in future.

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