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Research Article

Phytochemical and Phytoelemental Profile of *J. officinale*

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ABSTRACT
Recently, plant products have started gaining importance due to their significant contribution in tackling various health issues. The medicinal prominence of these plants lies in chemical constituents present in it, termed as "phytochemicals". Phytochemicals are naturally occurring secondary metabolites derived from plants which may be biologically active. Several major groups of phytochemicals such as flavonoids, glycosides, tannins, coumarins, terpenoids, cinnamic acids, and alkaloids etc. have been reported to possess specific bioactivities. In addition to these chemical components, "phytoelements" present in plants are also responsible for their medicinal properties either collectively or individually. Hence, detection of phytoelements is equally important in addition to the identification of phytochemicals, in order to correlate their presence as well as their synergistic impact on therapeutic efficacy of a particular medicinal plant associated with specific bioactivity. Thus, the present study deals with the phytochemical studies of *J. officinale* leaves in five different solvents with increasing polarity viz. hexane, chloroform, ethanol, methanol and water. Preliminary phytochemical screening of these fractions showed the presence of alkaloids, carbohydrates, coumarins, flavonoids, saponins, tannins and terpenoids. Though, the results reveal that the aqueous fraction has the maximum phytochemicals, qualitatively as well as quantitatively. Laser-induced breakdown spectroscopy (LIBS) was used for detection of elements present in aqueous fraction of *J. officinale* leaves and the spectral analysis indicated the significant presence of Potassium (K), Sodium (Na), Calcium (Ca) and Magnesium (Mg). Whereas, Oxygen (O) and Nitrogen (N) were present to a lesser extent comparatively. Very encouraging results are in hand on correlating the presence of these phytochemicals, and phytoelements with the specific therapeutic efficacies of *J. officinale* leaves and hence its aqueous fraction could be explored further as a novel therapeutic agent.

Keywords: Phytochemical, phytoelements, *J. officinale*, Laser-induced breakdown spectroscopy etc.

INTRODUCTION

The use of herbs as complementary and alternative therapy to existing medications for the prevention of health is mounting worldwide. About 80% of the world's population in the developing countries relies on plants and plant derived products for treatment of various diseases, primarily because of their universal acceptability, better compatibility with the human body and with lesser or no side effects[1-4].

Medicinal properties of the plants are basically due to the bioactivity of certain phytochemicals as well as phytoelements and it might be either due to their individual effect or synergistic effect. The amount of bioactive phytochemicals present in plants varies considerably from species to species and strongly depends on plant's age and various ecological and climatic factors[5]. Mostly these phytochemicals are secondary metabolites which are synthesized in plants during defense activities against microorganisms, insects and herbivores[6]. During the last two decades, the pharmaceutical industry has made massive investment in pharmacological and chemical researches all over the world in an effort to discover much more potent drugs. In this rationale, it has been of much interest to identify and isolate the bioactive compounds of plant origin in order to provide new sources of raw materials for development of phytodrugs with enhanced efficiency and efficacy.

Jasminum officinale Linn. (Family: Oleaceae) commonly known as 'Jasmine' is a garden plant found throughout Asia and generally used in aroma therapy. The antiseptic, antispasdomic and wound healing property of *J.officinale leaves* been reported in ancient Indian literature[7]. However, studies on its scientific evaluation are unavailable. The present study is an interdisciplinary research deals with phytochemical as well as phytoelemental screening of *J.officinale* leaves and their correlation with its bioactivities. The study involves distinctive combination of physical, chemical and biological techniques used for unveiling the scientific analysis. Thus the present study involves the chemical tests based screening of phytoconstituents as well as LIBS based screening of *J.officinale leaves.*

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Table 1: Phytochemical screenings of different fractions of *J. officinale* leaves.

Phytochemicals	J1	J2	J3	J4	J5
Alkaloids	-	-	+	++	+++
Anthraquinones	-	-	-	-	-
Carbohydrate	-	-	-	+	+
Coumarins	-	-	+	+	++
Emodins	-	-	-	-	-
Flavonoids	-	-	++	++	+++
Saponins	-	+	+++	+++	++
Steroids	-	-	-	-	-
Tanins	-	+	+	++	+++
Terpenoids	-	-	+	++	++

MATERIALS AND METHODS

Plant material

Fresh leaves of *J. officinale* L. (500 g) were collected from the local area of Allahabad, India and authenticated by Prof. D. K. Chauhan, Taxonomist, Department of Botany, University of Allahabad, India. The leaves of the *J. officinale* were washed well with distilled water, shade dried at room temperature, coarsely powdered (500 g), and then extracted with each solvent of increasing order polarity from hexane, chloroform, ethanol, methanol and finally with distilled water successively, using Soxhlet apparatus for 8 hrs at 24℃±5. The collected fractions were concentrated using a rotatory vacuum evaporator at 40℃ for drying of sample. Dried powder of different extracts of *J. officinale* leaves were stored in bottles, labeled as *viz.* hexane (**J1**), chloroform (**J2**), ethanol (**J3**), methanol (**J4**) and aqueous (**J5**) fractions, and kept in refrigerator for further experimental analysis.

Chemicals

All the chemicals and solvents used were of analytical grade. Ferric chloride, acetic acid , sulphuric acid, lead acetate, chloroform, ethanol, hydrochloric acid, alpha naphthol, sodium hydroxide, picric acid, potassium iodide, ammonium hydroxide, benzene, ammonia and isoamyl alcohol were purchased from Sigma Aldrich, New Delhi, India.

Phytochemical screening of different fractions of J. officinale

Chemical tests were carried out on the selected five *fractions* of *J. officinale* leaves using standard procedures[8-9] to identify the major classes of phytoconstituents present, as described below:

Test for Alkaloids

Wagner's test: 2 mg of aqueous extract was acidified with 1.5% v/v of hydrochloric acid ad mixed with few drops of Wagners's reagent. A yellow or row precipitate indicates the presence of alkaloids.

Mayer's test: few drops of *Mayer'*s reagent were mixed with 2 mg of extract. Formation of pale yellow precipitate indicates the presence of alkaloids.

Test for Anthraquinones

Borntrager's Test: 3ml of extract was shake with 3 ml of benzene, followed by the addition of 10% ammonia solution. Mixture was shaken, a pink red or violet color indicates the presence of free anthraquinones

Test for Carbohydrates

Molisch test: 2 ml of compound solution was placed in a test tube and two drops of the Molisch reagent (a solution of α-napthol in 95% ethanol) was added to it. The solution is then poured slowly into a tube containing two ml of concentrated sulfuric acid so that two layers were formed. The formation of a purple product at the interface of the two layers will confirm the presence of carbohydrate/glycosides

Test for Coumarins

2ml of extract was shake with 3 ml of 10% NaOH, formation of yellow color indicates the presence of coumarins.

Test for Emodins

2 ml of aqueous solution of ammonia was mixed with 3 ml of benzene and the then mixture was shake with plant extract, appearance of red color confirms the presence of emodins.

Test for Flavonoids

Small amount extract was dissolved in 50 ml of ethanol or water followed by the addition of 1ml of lead acetate. The appearance of pale yellow color will confirm the presence of flavonoids.

Test for Saponins

Foam Test: aqueous extract was vigorously shake with formation of stable honeycomb like froth or foam shows the presence of saponins in the extract.

Test for Steroids

Salkowski's Test: 2 ml of organic extract was mixed with 2 ml of chloroform followed by the slow addition of 3 ml of sulphuric acid. Reddish brown coloration indicates the presence of steroidal moiety in extract.

Test for Tannins

Braemer's Test: Small amount of compound was stirred with 5 ml of distilled water. It was then filtered and filtrate was treated with ferric chloride reagent. The appearance of dark green color precipitate will confirm the presence of tannin.

Test for Terpenoids

Compound was dissolved suitable solvent ad the mixed with 2ml of chloroform and few drops of conc. H_2SO_4 acid was added to it, appearance of deep red color will confirm the test.

Phytoelemental screening of J. officinale leaves

Detection of phytoelements responsible for therapeutic efficacy of ***J. officinale*** leaves was done with the help of its LIBS data.

Experimental Setup for LIBS analysis

The LIBS spectra of aqueous fraction of *J. officinale* leaves was recorded for identifying the presence of best set of phytoelements responsible for their biological efficacy. The experimental set up of LIBS contains frequency doubled (532 nm) Q- switched Nd: YAG high power pulsed laser (Continuum Surellite III-10) of pulsed width 4 ns (FWHM) and varying rate of repetition up to 10 Hz having maximum deliverable energy of 425 mJ. For LIBS analysis of *J. officinale* leaves we have prepared it in pellet form. The pellet is placed on sample stage and laser beam is focused with the lens of 15cm focal length to produce plasma on sample surface. On cooling plasma the spectral

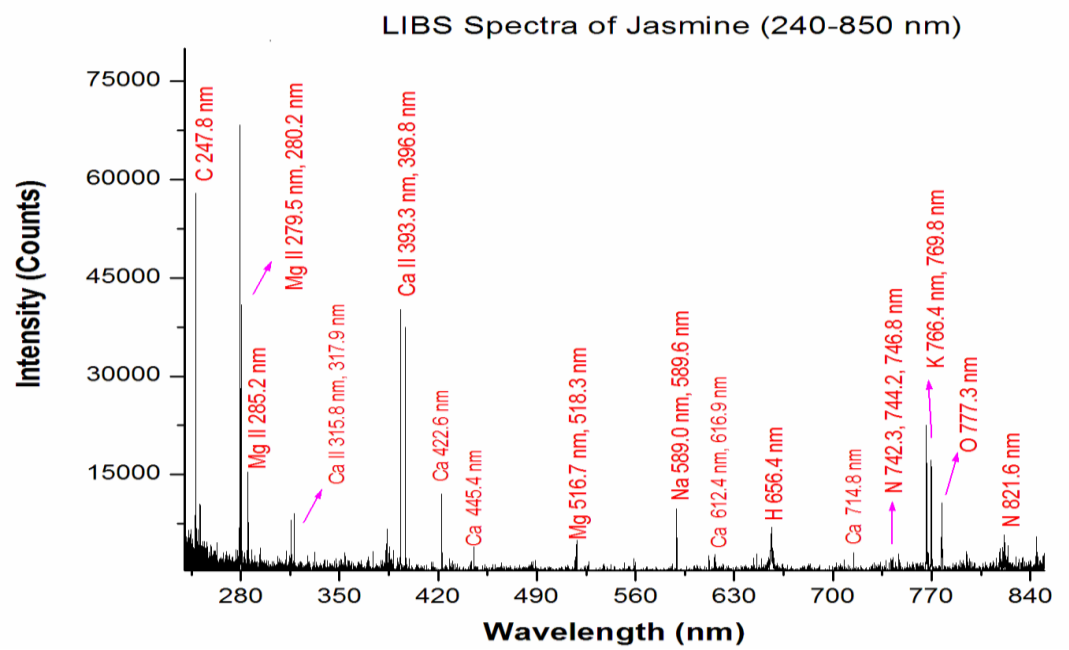

Figure 1: LIBS spectra of the aqueous fraction of *J. officinale leaves.*

Table 2: Intensity ratio of different elements of C. maxima with respect to C (247.8 nm) in spectral range (240-850 nm).

Elements	Wavelength (nm)	Element ref.	Intensity Ratio by C (247.8 nm)
Mg	518.3	Mg/C	0.67
Ca	422.6	Ca/C	0.85
K	769.7	K/C	1.56
Na	589.0	Na/C	1.44
Si	288.1	Si/C	0.03
H	656.2	H/C	0.38
O	777.1	O/C	1.02
N	746.8	N/C	0.22
C	247.8	C/C	1.00

emission are collected through collimator and optical fiber. The LIBS signal of range 200 nm- 900nm is fed to high resolving spectrometer (Mechelle ME 5000, Andor) which is imbedded with Intensified Charged Coupled Device (ICCD, iSTAR 334, Andor technology) detector system and synchronized with Digital Delay Generator (DDG, DG535) and connected with computer system which is installed with Andor Solis Software[10].

RESULTS

Phytochemical screening of J. officinale leaves

Table 1 deals with the results of phytochemical analysis of all the fractions of ***J. officinale leaves***. Fractions J5 and J4 showed the presence of maximum phytochemicals viz. alkaloids, carbohydrates, coumarins, flavonoids, saponins, tannins and terpenoids in significant amount. However, in fraction J3 only carbohydrate was absent. Whereas, fraction J2 showed the presence of only two classes of phytochemicals viz. saponins and tannins. Moreover, fraction J1 reveals the complete absence of any phytochemical during analysis. Color intensity of resultant test solutions were linked to the quantity of the particular phytochemical group in that specific fraction. Results in table 1, marked as **+++, ++ , +,** are based on abundance of phytochemicals.

Phytoelementel analysis of J. officinale leaves

Figure 1 shows the LIBS spectra of the aqueous fraction of *J. officinale leaves* in the spectral ranges of 240–850 nm. Relative concentrations of elements present in selected extracts are evaluated by measuring the intensity of the selected lines in triplicate from the LIBS spectra of the sample. Table 2 shows the relative intensity ratios of different phytoelements of the *J. officinale leaves in* spectral range (240-850 nm) with respect to C (247.8 nm).

DISCUSSION

Phytochemicals present as secondary metabolites are mostly bioactive in nature which effects metabolic processes. The preliminary phytochemical analysis was qualitative and it reveals the presence of alkaloids, carbohydrates, coumarins, flavonoids, saponins, tannins and terpenoids in various fractions of *J.officinale* leaves. A large growing evidence shows how the phytochemicals regulate the activities of metabolizing enzymes, modulate nuclear receptors and gene expression. Phytochemicals such as alkaloids affect the central nervous system, reduces appetite and behaves as diuretic[11]. Flavonoids and other phenolics have antioxidant activity that help to protect cells against the oxidative damage caused by free radicals. Since, flavonoids are the water soluble antioxidants and free radical scavengers, therefore they prevent oxidative cell damage and help in managing diabetes induced oxidative stress as well[12]. The high tannin content results in antiseptic properties in addition to tightening tissues as well as treating minor bleeding[13]. Terpenes have a unique antioxidant activity in their interaction with free radicals. Terpenoids have been found to be responsible for

various bioactivities viz. anti-microbial, antiviral, anti-hyperglycemic and anti-inflammatory etc.[14]

In addition to phytoconstituents, trace and macro elements also play a vital role in providing the bioactive attributes to the medicinal plants as they control most of the important biological process like facilitate the binding of molecules to receptor sites on cell membrane, and to prevent or allow specific molecules to enter or leave a cell. Inspite of beings availability of several techniques, Laser Induced Breakdown Spectroscopy (LIBS) has emerged as a sensitive, reliable, and quick analytical technique which works on the principle of elemental analysis, based on atomic emission, from micro plasma, generated by focusing high power pulsed laser beams on the surface of the sample[15].

The LIBS based identified major elements of *J. officinale* leaves are Ca, K, Mg and Na etc. The intensity of the observed spectral lines in *LIBS analysis,* corresponding to major and minor elements present in the *J. officinale* leaves, *is* not only suggests the concentration of the specific element, but it also correlate the importance of plant preparations in the various metabolic pathways. The micro-minerals such as Na, K, Mg, P and Ca serve as structural components of tissues and as constituents of body fluids. These minerals are also essential for the function of cells (Mertz, 1981). The role of some inorganic elements such as Mg, K, Ca, Mn, Al and traces of Fe and Cr in improvement of impaired glucose tolerance and their indirect role in the management of diabetes mellitus are being increasingly recognized[16].

Since, certain set of phytoelements is responsible for specific bioactivities of plants therefore, the presence of LIBS based identified major elements viz. Ca, K, Mg and Na of *J. officinale* leaves could be very well correlated with their common bioactivities viz. antidiabetic, antioxidant and antimicrobials[17]. For examples Mg is one of the most common cofactor present in the body. It allows enzymes to functions properly, which in turn enable a plays a vast majority of the body's chemical reactions[18]. Similarly Ca plays pivotal role in the physiology and biochemistry of the cells. Many enzymes also require calcium as a cofactor in the blood clotting cascade. Extracellular Ca is also important for proper bone formation[19].

Thus, the synergistic effect of certain set of phytoelements and the presence of specific major classes of *compounds* present in significant amount in *J. officinale* leaves must be responsible for its therapeutic efficacy such as antidiabetic and antioxidant. Hence, the leaves of *Jasminum officinale* could be explored as a replacement of synthetic antioxidants and antidiabetic agents.

CONCLUSIONS

Thus, it could be conclusively stated that *J. officinale* leaves are of high medicinal value and could be explored further for the development of novel antidiabetic agent not only for treating diabetes but also for managing diabetic complications.

CONFLICTS OF INTEREST

There are no conflicts of interest.

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