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Medicinal plant vasaka could be a therapeutic option for the management of COVID-19 symptoms

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Abstract

Introduction: Corona virus disease 19 (COVID-19) outbreak is a current pandemic that causes acute respiratory syndrome with huge mortality worldwide. The chief clinical features of COVID-19 is the presence of respiratory symptoms, with severe cardiovascular and renal complications in some patients. This study explores the potentiality of Vasaka (*Adhatoda vasica* Nees) in the prevention and management of symptoms associated with COVID-19. Vasaka is a well-known natural shrub in Ayurveda system of medicine which has a beneficial effects, particularly in respiratory disorders.

Methods: First, we reviewed various researches on Vasaka, and its use in the management of respiratory system related diseases, viral diseases and other diseases in various journals and Ayurveda classical texts. Second, a survey based study was conducted to assess the effectiveness of Vasaka in the prevention and management of respiratory related problems.

Results: The literature review revealed that Vasaka has been widely studied for its pharmacological activities. It has various action like antiviral, hepatoprotective, antibacterial, anti-inflammatory, cardioprotective, antitubercular and antioxidant. The survey results of the study indicated that only 15% of the sampled respondents used Vasaka in the treatment of respiratory related diseases. Nevertheless, among the respondents who used the plants, 97% stated that the use of Vasaka was useful in the treatment of diseases. Interestingly, 36.4% of the sampled respondents reported that they were completely recovered from the respiratory related diseases.

Conclusions: Due to Vasaka multi-modal therapeutic effects and the findings from the survey-based research indicate the potentiality of its use in the management of COVID-19 symptoms.

Keywords: Ayurveda; Corona Virus; Medicinal plants; Respiratory syndrome; Vasaka, *Adhatoda vasica*, *Justicia adhatoda*.

1. Background

The widespread of the coronavirus (COVID-19) is unique and unprecedented threat for human health all over the globe. Corona viruses (2019-nCoV/SARS-CoV2) is a single stranded, enveloped, positive sense RNA viruses which belong to family Coronaviridae, ^[1]. Despite the huge effort and investment, there are no standard medicine developed to treat the disease. Due to its high rate of transmission and unavailability of specific medicine and vaccine for its treatment WHO declared it as a pandemic disease ^[2]. Coronaviruses have been the cause behind severe acute respiratory diseases in human ^[3]. This study provides an empirical investigations on the potential and possibilities of Ayurveda based medical system in the management of the disease symptoms.

Ayurveda is the world's oldest medical system and is equipped with varieties of treatment modalities to handle various type of deadly diseases. According to Ayurveda the Sareera (Body) is composed of Dosha (humours like Vata, Pitta and Kapha), Dhatu (Tissues like Rasa, Rakta, Mamsa etc.) and Mala (waste products like fecal matter, Urine and Sweat) ^[4]. Ayurveda describes health as a state of equilibrium of Dosha, Dhatu, Mala and normal function of Agni (Digestive fire) along with well-being of mind, sense organs and soul ^[5] and in other hand disequilibrium of Dosha, Dhatu and Mala leads to the disease ^[6]. Ayurveda focuses on treating different disease by balancing these three pillars of life. The general causes for diseases are Asatmyendriyarthasamyoga (Abuse of senses), Pragyaparadha (abuse of intellect) and Kala/Parinama (Seasonal variation) ^[7]. The diseases generally classified as Nija (endogenous) and Agantuja ^[8] (exogenous) which can be compared with Communicable and Non-Communicable diseases respectively according to Ayurveda.

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The therapeutic potential of alternative medicine is not really being considered during this crisis and global search for effective preventive and treatment measures. In Ayurveda different treatment principles for communicable disease are described in detail. Specific measures like Sthana parityaga (change of place of living), Homa-Dhupana (Fumigation) Niyama (observing rules and regulations), Panchakrma, therapy (body purification), Rasayana chikitsa (Rejuvenation) and Aushadha (Medicine) has been mentioned which are useful in communicable disease and in Janapadodhwamsa Janya Vyadhi (epidemic condition) [9]. Along with other measures Aushadha (Medicine) mainly prepared from a medicinal plants play a key role in the management of different disease. Different medicinal plants are described in Ayurveda for the treatment of such type of pandemic disease among them Vasaka is one of them. In the present study, we have chosen Vasaka as herbal medicine which has been used since the vedic period in the treatment of different respiratory system related disease, This study further explores the potentiality of this plant parts in the management of COVID-19 related symptoms.

2. Materials and Methods

This study followed two approaches. First, we conducted a systematic review of literature published in peer reviewed journals and Ayurveda classical texts. The literature was explored through online internet searches, including database such as Google Scholar, Scopus, PubMed, Science direct and CrossRef. The main keywords used for searching articles included: Adhatoda vasica, Justicia adhatoda, Vasaka,

Coronavirus, SARS coV 2, CoVID-19 and Antiviral.

Second, a survey based study was conducted to assess the effectiveness of Vasaka plant parts in the prevention and management of respiratory related problems such as common cold, cough, and difficulty in breathing. The study was undertaken in the Tanahun district of Nepal. Ward number 1 of the Myagde rural municipality in the Tanahun district was purposively selected due to two reasons. First, the principal investigator of this study is originally from the respective area so that it is easier to contact local leaders and then the potential respondents of the study. Second, the principal investigator is aware that Vasaka plant is widely found in the area.

The selection of respondents from the study area was by means of systematic random sampling. First, we obtained the list of people living in the study site. This was obtained from the Nepal government website (<http://www.election.gov.np/election/np/voter-list.html>) where there is a list of voters for the previous election. From the total of 2391 individuals in the list, we selected every fifth person by following the systematic random sampling procedure. This yielded 478 individuals. Out of the total 478 selected persons, we were able to make contact via phone to 257 respondents. The phone numbers were obtained from local leaders in respective villages. Among those 257, we were able to get information from 215 individuals. The information was collected through phone interviews using a structured set of questions (Table 1). The interviews were conducted from 10 to 25 June, 2020. On average, an interview took 5 minutes to complete.

Table 1: Questions used in the interview

1. What gender do you identify as?	Male... Female...
2. How old are you?	... years
3. What is your education level?	... years
4. Are you employed?	Employed... Not employed...
5. What is the distance from your home to the nearest hospital in minutes by commonly used means of transportation	... minutes
6. Have you ever used medicinal plants in the treatment of any diseases?	Yes... No...
7. Have you ever used Vasaka (Asuro) plant parts to treat any respiratory diseases such as common cold, cough, bronchitis, difficulty in breathing etc?	Yes... No...
8. How effective was the use of Vasaka plant parts in the treatment of above diseases?	Negative effect... No improvement in the symptoms... Little improvement ... Moderate improvement ... Very effective... Completely recovered...

3. Results

3.1 Review results

Plant description

Vasaka is an evergreen shrub of 4-8 feet in height with many long opposite branches. Leaves are 3-8 inches in length and lance-shaped, opposite and stipulate. Stem is herbaceous above and woody below. Flowers are spikes, small irregular zygomorphic, bisexual, and hypogenous. The flowers are either white or purple in colour. It has four seeded fruits with capsule [10].

Plant classification

Kingdom: Plantae; Order: Lamiales; Family: Acanthaceae; Genus: Adhatoda; Species: Vasica; Common name: Adhatoda, Vasaka, Vasa; English Name: Malabar nut; Nepali Name: Asuro

Ayurveda Properties of Vasaka (Justicia adhatoda L.)

As per the description available in Ayurveda classics, therapeutic effect of medicinal plants depends upon certain pharmacodynamics properties. These pharmacodynamics properties are Rasa, Guna, Veerya, Vipaka, Prabhava etc. Properties of Vasaka [11]:

Rasa: Tikta, Kasaya

Guna: Rukshya, Laghu

Veerya: Shita

Vipaka: Katu

Doshakarma: Kapha Pitta Samaka, Jwaraghna, Swashahara, Kasahara, Shlesmahara, Raktastambhaka, Mutrajanan.

Adhatoda vasica commonly known as Vasaka, is found in many regions of Nepal, India and throughout the world. Adhatoda leaves, root and flowers have been used extensively in Ayurvedic medicine for the treatment of Tamak swasa (Bronchial Asthma), Rajayakshma (Pulmonary tuberculosis), Jwara (Fever), Atisara (diarrhea), Pravahika (dysentery),

Kustha roga (skin diseases), chhardi (vomiting), Pratisyaya (Common cold), Pinas (Sinusitis), Mutradaha (Burning micturition), Hridayarog (Heart disease), etc. [12].

Chemical Composition

The main chemical component found in *Adhatoda vasica* Nees is a bitter quinazoline alkaloid called vasicine which is present in the leaves, roots and flowers. Besides vasicine, the leaves contain several alkaloids such as Vasicinone, Vasicinol, Adhatodine, Adhatonine, Adhvasinone, Anisotine and Hydroxypeganine, betaine, steroids and alkanes [13].

Therapeutic action

One animal study shows that aqueous and methanol extract of *Adhatoda vasica* has potent anti-viral agents against herpes simplex viruses [14]. In another study Chavan et.al has suggest that aqueous and methanolic extracts of *Justicia adhatoda* have strong anti-influenza virus activity that can inhibit viral attachment and viral replication. It was possibly by blockage of viral attachment through inhibition of viral HA protein, by blocking the viral absorption to cells, by synergistically binding to the free virus particles or by blocking the sialic acid receptors to prevent virus entry into the cells and by inhibiting the replication of influenza virus or virus budding from the infected Madin-Darby Canine Kidney (MDCK) cells [15].

Vasaka has the antibacterial activity against Gram positive and Gram-negative bacteria. The extract of *Vasaka* revealed higher activity against different clinical pathogens like *Klebsiella pneumonia*, *Proteus vulgaris*, *Staphylococcus aureus*, *Streptococcus Pyogens* and *Pseudomonas aeruginosa*

[16]. One study showed that leaf extract (methanolic) of *Adhatoda Vasica* and *Vitex negundo* was effective against *Salmonella typhi* [17].

The study suggested that the methanolic, diethyl ether and chloroform extracts of leaves of *Adhatoda vasica* have a immunomodulatory properties [18]. Another animal study suggested that Ethyl acetate extract of *Adhatoda vasica* has potent hepatoprotective effect against CCl₄ - induced liver damage [19].

The main chemical constituent of *Adhatoda vasica*, vasicine showed bronchodilatory activity both in vitro and in vivo study [20]. Similarly the antitussive activity of *Vasaka* extract was evaluated in anaesthetized guinea pigs, rabbits and in unanaesthetized guinea pigs and it was found that it have a good antitussive activity [21]. In another experimental study ethanol extracts of *Glycyrrhiza glabra* and *Adhatoda vasica* shows significant improvement in SO₂ gas induced cough [22].

Semi-synthetic derivatives of vasicine from the herb *Adhatoda vasica*, have a pH-dependent growth-inhibitory effect on *Mycobacterium tuberculosis* [23]. In another study chemical constituent's vasicine and vasicinone have shown significant cardiac depressant effect [24].

3.2. Survey results

The survey results show that 73% of the respondents have used medicinal plants in the treatment of some diseases. However, only 15% reported that they have used *Vasaka* plant parts in treating respiratory related diseases (Table 2).

Table 2: Use of medicinal plants by respondents' characteristics

Respondent characteristics	Overall (n=215)	Medicinal plants		Vasaka plants	
		Used (n=157)	Not used (n=58)	Used (n=33)	Not used (n=182)
Gender (Male %)	42.3	33.1	67.2	36.4	43.4
Age (Years)	49.7	51.2	45.8	52.5	47.2
Education (Years)	8.1	8.2	7.1	8.4	8.1
Employment status (Employed %)	68.8	69.1	66.5	69.7	68.7
Distance to hospital (Minutes)	63.1	63.4	62.9	67.7	62.3

Survey results show that 42.3% of the sampled respondents are male. Among the users of medicinal plants, 33.1% are male and among the non-users of medicinal plants, 67.2% are male. Similarly, among the *Vasaka* plant users 36.4% are male whereas among the non-users of *Vasaka* plants, 43.4% are male. The average age of the respondents is 49.7. The age of medicinal plants users is significantly higher than that of non-users ($P < 0.01$). Similarly, the age of *Vasaka* plants users is significantly higher than that of non-users ($P < 0.05$). On average, respondents have attained 8 years of education. 68.8% of the respondents were employed. We do not find significant difference between the users and non-users of medicinal plants and *Vasaka* plants in relation to education and employment status. On average, it takes 63.1 minutes to reach the nearest hospital from respondent's home. There is no significant difference between users and non-users of medicinal plants in relation to distance from home to hospital. However, this distance is significantly ($P < 0.01$) higher in the case of *Vasaka* plants users in comparison to non-users. This result indicates that those who live farther away from hospital are more likely to use *Vasaka* plants.

When asked about the effectiveness of *Vasaka* plant parts in the treatment of respiratory disorders, 36.4% reported that they were completely recovered from the disease by the use of *Vasaka* plant parts (Figure 1). Similarly, 30.3% of the

respondents who used *Vasaka* plants in the treatment of respiratory diseases stated that the use of plant parts was very effective in the treatment of the disease. Moreover, 21.2% and 9.1% said the use of the plant parts resulted moderate and little improvement respectively, in the disease symptoms. A few respondents (3%) reported that the plant parts was not effective in the treatment of the diseases. We also asked if the use of *Vasaka* plant parts had caused any negative effects on them, however, none of the respondents reported negative effects of the use of the plant parts. (Figure 1.)

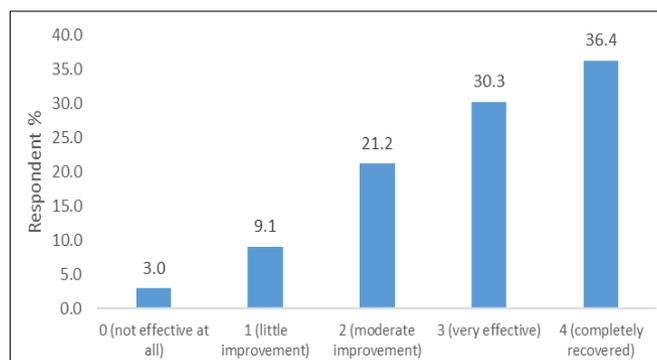


Fig 1: Respondents' experience on the effectiveness of *Vasaka*

4. Discussion

An outbreak of pneumonia in December, 2019 in Wuhan, China, has now been determined to be caused by a novel coronavirus. Due to its severe effect in respiratory system it is named as severe Acute Respiratory Syndrome Coronavirus 2 (SARSCoV-2) [25]. Vasaka is a well-known shrub in Ayurveda systems of medicine. The classical Ayurvedic medicine prepared from the Vasaka plant is used in many respiratory system related disease like Tamak Swasa (Bronchial Asthma), Pratishaya (Rhinitis), Pinas (Sinusitis), Rajakshma (Pulmonary tuberculosis), Kasa (Cough) and Swasa (Breathing disorder) since vedic period. Numerous clinical trials have shown that Vasaka has been beneficial in the management of various diseases like pulmonary disease, inflammatory diseases, cardiovascular diseases, metabolic diseases, liver diseases, neurological diseases. Vasaka leaves decoction has a soothing effect on irritation in the throat and it acts as an expectorant [26].

The literature survey revealed that Vasaka has been widely studied for its pharmacological activities. It has vasicine, vasicinone and vasicolone as a major chemical constituents. These primary alkaloids are well established as a therapeutical respiratory agents. Previous experimental and clinical trials demonstrated that Vasaka has antiviral action. It has shown antiviral action against different viruses indicating that it could be a therapeutic option for the management of COVID-19 related symptoms.

The survey results of the study indicate that only 15% of the sampled respondents used Vasaka plants in the treatment of respiratory related diseases. Nevertheless, among the respondents who used the plants, 97% stated that the use of plant parts was useful in the treatment of diseases. Interestingly, 36.4% of the sampled respondents reported that they were completely recovered from the respiratory related diseases with the use of Vasaka plant parts. The findings of this study indicate that Vasaka plant parts can be potentially utilized in the treatment of respiratory related diseases. However, there are several limitations of this study. First, the survey was conducted in only one district of Nepal. Second, we do not know the intensity of the plant parts used in the treatment. Thus, we recommend, further detail studies on the potentiality and effectiveness of Vasaka plant parts. Nevertheless, this study provides an evidence on the usefulness of Vasaka plant parts in the treatment of respiratory related diseases.

One of the challenges with medicinal plants is that such plants can be produced only in specific environmental conditions and requires intensive care in growing. This is linked with the high cost of producing associated drugs. Thus, economics of producing medicinal plants in adequate quantity is a concern. However, Vasaka plant's distribution in wide range of climatic conditions indicates the potentiality of large-scale production.

5. Conclusion

Due to Vasaka multi-modal therapeutic effects, we hypothesize that Vasaka could be effective in the prevention and Management of COVID-19 symptoms. Existing literature and the findings from the survey-based research indicate the potentiality of Vasaka plant parts in the management of COVID-19 symptoms. However, there is no standard formulation regarding the use of the plant parts, this is limiting its wider use. In this context, we recommend translational research in order to provide scientific evidences for the efficacy and to establish the standard formulation of

Vasaka in the management of COVID-19 systems.

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Conflicts of interest

There are no any conflicts of interest.

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