Medicinal properties, phytochemistry and pharmacology of Withania somnifera: an important drug of Unani Medicine

Amrin Saiyed*, Nasreen Jahan, Sana Fatima Majeedi, Mariyam Roqaiya

Abstract

Withania somnifera Dunal. is a well known Indian medicinal plant widely used in the treatment of many clinical conditions in India. It is an important drug commonly known as Asgand which has been used either single or in combination with other drugs in Unani as well as Ayurvedic system of medicine for centuries. Withania somnifera holds a place in Ayurveda similar to that of ginseng has in Chinese medicine. Asgand is commonly known as Indian ginseng or Indian winter cherry. It has been described by Dioscorides (78 AD) in his book “Kitab-ul-Hashash”. The objective of this paper is to review the literature regarding Withania somnifera Dunal. The search was carried out through Unani classical books via library, ethno botanical literature, journals and electronic search. Asgand consists of the roots of Withania somnifera which has various therapeutic actions such as female disorders, cough, rheumatism and dropsy and as a sedative in case of senile debility. Chemical analysis of Asgand shows that it contains several alkaloids such as withaferin A, withanolide A and withanolide D and various other constituents. Research studies have shown that it possesses anti-inflammatory, anti-oxidative, antimicrobial, anti-anxiety, aphrodisiac, immunomodulation, anti-diabetic, anti-ulcer, anticancer, central nervous system depressant and hepatoprotective activities. An extensive review of ancient literature of Unani medicine revealed that the drug having numerous therapeutic action such as Muhallile warm (anti-inflammatory), Moallide mani (semen producer), Musakkin (sedative), Muqawwie am (General tonic) and Muqawwie Bah (aphrodisiac). Keeping in view the medicinal properties of Withania somnifera Dunal (Asgand), an attempt has been made in this review paper to explore various dimensions of the drug including botanical, chemical and pharmacological studies of plant besides its traditional uses in Unani Medicine.

Keywords: Withania somnifera, Withanolide, Phytochemistry, Unani Medicine.

INTRODUCTION

Withania somnifera Dunal. belongs to the family solanaceae. This shrub is found in the drier parts of India, Sri Lanka, Afghanistan, Baluchistan, Sind, parts of Africa and is distributed in the Mediterranean regions, the Canaries and Cape of Good Hope [1]. It is found in high altitude ascending to 5,500 feet in the Himalayas. It grows wildly throughout India particularly in hotter parts, on waste places and on road sides. It is also cultivated for medicinal purposes throughout India [2,3]. It is widely cultivated in mandsaur of Madhya Pradesh, adjoining area of Rajasthan village and garhwal hills. In Unani system of medicine, roots of Withania somnifera commonly known as Asgand are used for the medicinal properties [4]. Roots collected in winter during January to March, dried under shade for several days, washed and cut into short pieces [3,5]. It is believed that the supplies of the roots were from Nagpur (Rajasthan) and were obtained from the wild plants grown in this region. Now days, except for a limited collection of the roots from wild plant growing in Bikaner and pilani area of Rajasthan most of the roots obtained from the cultivated plants [6]. The drug retains its therapeutic efficacy for less than 2 years. It is prone to decomposition and loses its potentials within 2 years. So the fresh dried roots are preferred for medicinal uses. Two varieties of Asgand have been mentioned in classical Unani literature Asgand Nagori and Asgand Dakani. Asgand Nagori is preferred for its more potential medicinal properties [7].
Scientific classification [9]

Kingdom: Plantae
Division: Angiosperms
Class: Dicotyledon
Order: Tubiflorae
Family: Solanaceae
Genus: Withania
Species: somnifera

Vernacular names

Arabic: Kakanj Hindi [3]
Bengali: Ashvagandha, Asvagandha
English: Winter cherry
Hindi: Asgandh, Punir
Kannada: Angabera, Hirenaddina-Hire-gadday
Marathi: Asgandha, Askagandha, Askandhatilli [12]
Oriyan: Asugandha
Persian: Asgandh Nagori, Kaknjae Hindi
Sanskrit: Ashvagandha, Gandhrapatri, Pa
Urdu: Asgand Nagori

Unani name

Asgand[1]

Botanical name

Withania somnifera (Linn.) Dunal [10] (Family: Solanaceae)

Synonyms

Withania ashwagandha Kaul [10] Physalis flexuosa Linn. [13].

Mizaj (Temperament)

Hot and dry in third degree [1,14].

Maza

Mucilaginous, bitter and acrid [10].

Boo

Pungent odor, smell of horse’s urine [12].

Nafae Khas

Muqawwie bah (Aphrodisiac) [10].

Parts used

Dried roots.

Muzir (Adverse effect)

For throat. Person with hot temperament.

Musleh (Corrective)

Gargle with joshunda shehtoot shereen for throat, Kateera and roghan for hot temperament person.

Budal (Substitute)

Qust, Saruranjan and Behman safaid.

Miqdare Khoorak (Dose)

3 to 5gm [7-10]. Up to 14gm [11].

Murakkabat (Compound formulation)

Majoon muqawwie reham, Majoon zanjabeel, Habbe Asgand, Majoon suhaga, Majoon salah, Majoon samag, Kusha godants, Halva gheekvar, Zimade muhallil [17].

Afa’al (actions)

Muqawwie reham (Uterine tonic), [10].
Muqawwie aam (General tonic),
Muhallil waran (Anti inflammatory),
Muftatehe sudal (Deobstruents),
Musakkin (Relaxant),
Munawwim (Sedative),
Moaddile Akhat (Normalize humours),
Muftatehe hisaat (Lithotriptic),
Meaallide lahm (Galactagogue),
Musalfe khoon (Blood purifier) [7]
Moallide mani (semen producer) [10].

Istemaflat (Therapeutic Uses)

<table>
<thead>
<tr>
<th>Ailments</th>
<th>Approach</th>
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<tbody>
<tr>
<td>Genitourinary system</td>
<td>Zofe bah (sexual debility), Jyran mani (spermatorrhoea), Qillate mani (oligosperma) and Salanur reham (leucorrhoea). Infertility in woman</td>
</tr>
<tr>
<td>Anti-inflammatory</td>
<td>Kasrate tams (menorrhagia)</td>
</tr>
<tr>
<td>Skin</td>
<td>Hissate gurda wa masana (renal and vescicular calculi) and Toqiral bold (drubbling of urine)</td>
</tr>
<tr>
<td>Nervous system</td>
<td>It is good memory enhancer and reduces dementia [7, 10].</td>
</tr>
<tr>
<td>Cardiovascular system</td>
<td>It is useful in palpitation and shock [7].</td>
</tr>
<tr>
<td>Gastrointestinal system:</td>
<td>Blood purification</td>
</tr>
<tr>
<td></td>
<td>Bawasire khooni (Bleeding piles)</td>
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</tbody>
</table>

Botanical Description

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Macroscopic description</th>
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<tbody>
<tr>
<td>1</td>
<td>Habit</td>
</tr>
<tr>
<td>2</td>
<td>Stems and branches</td>
</tr>
<tr>
<td>3</td>
<td>Roots</td>
</tr>
<tr>
<td>4</td>
<td>Leaves</td>
</tr>
<tr>
<td>5</td>
<td>Inflorescence</td>
</tr>
<tr>
<td>6</td>
<td>Flowers</td>
</tr>
<tr>
<td>7</td>
<td>Calyx</td>
</tr>
<tr>
<td>8</td>
<td>Corolla</td>
</tr>
<tr>
<td>9</td>
<td>Androecium</td>
</tr>
</tbody>
</table>

Unani description

Botanical name: Withania somnifera (Linn.) Dunal [10] (Family: Solanaceae).


Mizaj (Temperament): Hot and dry in third degree [1,14].

Maza: Mucilaginous, bitter and acrid [10].

Boo: Pungent odor, smell of horse’s urine [12].

Nafae Khas: Muqawwie bah (Aphrodisiac) [10].

Parts used: Dried roots.

Muzir (Adverse effect): For throat. Person with hot temperament.

Musleh (Corrective): Gargle with joshunda shehtoot shereen for throat, Kateera and roghan for hot temperament person.

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Murakkabat (Compound formulation): Majoon muqawwie reham, Majoon zanjabeel, Habbe Asgand, Majoon suhaga, Majoon salah, Majoon samag, Kusha godants, Halva gheekvar, Zimade muhallil [17].

Afa’al (actions): Muqawwie reham (Uterine tonic), [10]. Muqawwie aam (General tonic), Muhallil waran (Anti inflammatory), Muftatehe sudal (Deobstruents), Musakkin (Relaxant), Munawwim (Sedative), Moaddile Akhat (Normalize humours), Muftatehe hisaat (Lithotriptic), Meaallide lahm (Galactagogue), Musalfe khoon (Blood purifier) [7] Moallide mani (semen producer) [10].
Ethnobotanical Literature

Rajputs regard the root as useful in rheumatism and dyspepsia. In Punjab, it is used for lumber pains and considered aphrodisiac. In Sind it is used to cause abortion. The sutos use a decoction of the root for cold and chills, asthma, while trasimal sutos administer it to tone up the uterus in women who habitually miscarry and in order to remove retained conception products. It is considered as a tonic and aphrodisiac by the Indian physician who use it in general debility, rheumatism and loss of appetite. A patient with chronic gastritis and marked loss of appetite and general debility was given a full course of the powdered root [8]. Root and bitter leaves are used as hypnotic in alcoholism and emphysematous dyspnoea. Powder of the root mixed with ghee and honey in equal parts is recommended for impotence or seminal debility, it is taken in the evening followed by milk. The decoction boil down with milk and with ghee added to the mixture is recommended for curing the sterility of women. It is to be taken for a few days, soon after the menstrual period [11].

Chemical constituents

The pharmacological activity of roots is attributed to the presence of several alkaloids [20, 21]. The total alkaloidal content of the Indian roots has been reported to vary between 0.13 and 0.31%. In all, 13 dragendorff positive components have been obtained chromatographically. They include cuscohygrine, anhygrine, tropine, pseudotropine and anaferine. There is another alkaloid called withisomine which is reepeted from the root of the plant grown in West Germany [9]. In addition to alkaloids the root are reported to contain starch, resin, fat, potassium nitrate, phytosterol, reducing sugars, hentriacontane glycosides, diculitol, withanial, stearc, palmatic, linoleic, withanic acid, ipuranol and somnirol [1]. Dr. Trebut in 1886 separated an alkaloid from the Mediterranean plant, which forms a crystalline sulphate having hypnotic action, but not producing mydriasis. He provisionally named the alkaloid somniferine [12]. The hypnotic and sedative properties are due to the presence of an alkaloid “somniferin.” The root contains several alkaloid including withanine, withanamine, pseudo-withanine, somnine, somniferine [22, 23]. Withiferin A has antitumor, antiarthritic, and antibacterial and anti-inflammatory activity. The root extract contains an ingredient which has GABA mimetic activity. The free amino acids present in the root include aspartic acid, glycine, tyrosine, alanine, proline tryptophan, glutamic acid and cystine [10, 24].

Physicochemical studies [1, 25]

Identity, Purity and strength assay

<table>
<thead>
<tr>
<th>Foreign organic matter</th>
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<tbody>
<tr>
<td>Ash values (%)</td>
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</tr>
<tr>
<td>Total Ash</td>
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<tr>
<td>Water soluble ash</td>
<td>3.0</td>
</tr>
<tr>
<td>Acid insoluble ash</td>
<td>1.5</td>
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<tr>
<td>pH values</td>
<td></td>
</tr>
<tr>
<td>1% solution</td>
<td>3.5</td>
</tr>
<tr>
<td>10% solution</td>
<td>3.5</td>
</tr>
<tr>
<td>Moisture content</td>
<td></td>
</tr>
<tr>
<td>Loss on drying at 105°C</td>
<td>8.70%</td>
</tr>
<tr>
<td>Solid contents</td>
<td></td>
</tr>
<tr>
<td>Petroleum ether</td>
<td>0.348%</td>
</tr>
<tr>
<td>Chloroform</td>
<td>0.304%</td>
</tr>
<tr>
<td>Acetone</td>
<td>0.305%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.184%</td>
</tr>
</tbody>
</table>

Pharmacological Properties

Adaptogenic activity and anti-stress activity

Withania somnifera roots were investigated against a rat model of chronic stress (CS). The stress procedure was mild, unpredictable footshock, administered once daily for 21 days to adult male Wistar rats. CS induced significant hyperglycaemia, glucose intolerance and increase in plasma corticosterone levels, gastric ulcerations, male sexual dysfunction, cognitive deficits, immunosuppression and mental depression. These CS induced perturbations were attenuated by Withania somnifera (25 and 50 mg/kg po) and by Panax ginseng (PG) (100 mg/kg po), administered 1 h before footshock for 21 days. The results indicate that Withania somnifera, like Panax ginseng (PG), has significant antistress adaptogenic activity, confirming the clinical use of the plant in Ayurveda [26].

Antimicrobial activity

Aqueous root extract of Asgand was found to possess strong antibacterial activity against methicillin resistant Staphylococcus aureus (MRSA) as revealed by the in vitro agar well diffusion assay. The separation of the bioactive compounds from the plant extract was carried out using two dimensional thin layer chromatography (TLC) and contact bioautography. The antioxidant activity was estimated to be Trolox Equivalent Antioxidant Capacity of 9.83mg/gm of dry weight of extract and reducing power was 0.11mg/gm of dry weight of extract using ascorbic acid as standard. Our study suggests that the bioactive fractions separated from aqueous extract of Withania somnifera are a potential source of antibacterial compounds with antioxidant property [23].

Anti oxidant activity

The antioxidant activity of Withania somnifera (WS) glycowithanolides was assessed in chronic footshock stress induced changes in rat brain frontal cortex and striatum. The stress procedure, given once daily for 21 days, induced an increase in superoxide dismutase (SOD) and lipid peroxidation (LPO) activity, with concomitant decrease in catalase (CAT) and glutathione peroxidase (GPX) activities in both the brain regions. Withania somnifera glycowithanolides (WSG), administered orally 1 h prior to the stress procedure for 21 days, in the doses of 10, 20 and 50 mg/kg, induced a dose-related reversal of the stress effects. Thus, WSG tended to normalise the augmented SOD and LPO activities.
and enhanced the activities of CAT and GPX. The results indicate that, at least part of chronic stress-induced pathology may be due to oxidative stress, which is mitigated by WSG, lending support to the clinical use of the plant as an antistress adaptogen [23].

**Immunomodulatory effect**

The efficacy of *Withania somnifera* on immunomodulation was tested in experimental azoxymethane induced colon cancer in mice. Azoxymethane 15 mg/kg was injected intraperitoneally once a week for 28 days. The colon cancer was confirmed by the appearance of aberrant crypt foci (ACF) in the colons of the experimental mice. The progression in colon tumor development was correlated with the appearance of the histological biomarker and ACF. Animals were treated with 400 mg/kg body weight of *Withania somnifera* extract once a week for four weeks orally. After that the animals were sacrificed and analyzed for immunocompetent cells, immune complexes and immunoglobulins. *Withania somnifera* significantly altered the level of leucocytes, lymphocytes, neutrophils, immune complexes and immunoglobulins (Ig) A, G and M. The azoxymethane induced colon cancer and immune dysfunction was better controlled by *Withania somnifera*. These results suggested that the immunomodulatory effects of *Witania somnifera* could be useful in the treatment of colon cancer [23].

**Effect of Asgand on sexual function and behaviours in diabetic rat**

The effect of *Withania somnifera* on sexual function in diabetic male Wistar rats was assessed by measuring the serum levels of testosterone, progesterone, estrogen, FSH and LH. Experimental diabetes mellitus type I was induced by intraperitoneal injection of a single dose (60 mg/kg) of streptozotocin (STZ) in Wistar male rats. Oral *Withania somnifera* root was given in pelleted food at ratio of 6.25% for 4 weeks. The levels of gonadotrophic hormones (LH, FSH), progesterone, estrogen and testosterone in animals’ serum were determined after 4 weeks in all groups. *Withania somnifera* root was effective in lowering FSH serum level compared to controls (p<0.05) in both diabetic and non-diabetic groups, whereas progesterone (p<0.05), testosterone (p<0.05) and LH levels (p<0.001) were significantly higher in non-diabetic treated animals. It is suggested that the drug may have a regulatory effect on diabetes-induced change of the levels of gonadal-hormones, especially progesterone, in male rats [26].

**Cardioprotective Effect**

This study was evaluate the cardioprotective potential of hydroalcoholic extract of *Withania somnifera* on the basis of haemodynamic, histopathological and biochemical parameters in the isoprenaline- (isoproterenol) induced myocardial necrosis in rats and to compare with Vitamin E, a known cardioprotective antioxidant. Wistar albino male rats (150–200 g) were divided into six main groups: sham, isoprenaline control, *Withania somnifera*/Vitamin E control and *Withania somnifera*/Vitamin E treatment groups. *Withania somnifera* was administered at doses 25, 50 and 100 mg/kg and Vitamin E at a dose of 100 mg/kg, orally for 4 weeks. On days 29 and 30, the rats in the isoprenaline control and *Withania somnifera*/Vitamin E treatment groups were given isoprenaline (85 mg/kg), subcutaneously at an interval of 24hr. On day 31, haemodynamic parameters were recorded and the hearts were subsequently removed and processed for histopathological and biochemical studies. Result show that *Withania somnifera* (25, 50 and 100 mg/kg) exerts a strong cardioprotective effect in the experimental model of isoprenaline-induced myonecrosis in rats. Significant restoration of most of the altered haemodynamic parameters may contribute to its cardioprotective effect. Among the different doses studied, *Withania somnifera* at 50 mg/kg dose produced maximum cardioprotective effect [27].

**DISCUSSION**

*Withania somnifera* Dunal, is a very important drug and is traditionally used to treat a number of health problems. Recent ethno botanical, phytochemical and pharmacological studies have reported the medicinal values of *Withania somnifera* Dunal and its active constituents. This review is provides evidence based scientific validation to some of its action and therapeutic uses described in ethno botanical literature and actions described for *Asgand* in classical text of Unani Medicine since long. The above literature showed that *Withania somnifera* Dunal, is an herb of enormous therapeutic effects and has been used in numerous ailments specially for sexual debility, Infertility, menstrual disorder, Arthritis and other inflammatory condition. A number of compounds are isolated from it; several alkaloids such as withosamine, withafarin, phytosterol, reducing sugars, glycosides, flavonoids and saponins are the most common which are responsible for its extensive use. Further studies are required to isolate other biological active constituents responsible for its therapeutic use and also to validate the traditional knowledge of *Asgand* [28-31).

**CONCLUSION**

In the recent years, traditional system of medicine have emerged as potential source to cope with the growing rate of chronic, degenerative, environmental, lifestyle and stress related diseases. This article briefly reviews the traditional knowledge, ethno medicinal, pharmacological and therapeutic application of the *Withania somnifera* Dunal. This is an attempt to compile and document information on different aspects of the plant and highlight the need for research and development.

**REFERENCES**