



Review Article

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

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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-Hashaish*”. 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 withosmine, withaferinA, 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 aam* (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 wildy 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 mandasaur 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 [7,8].

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 ^[10]
Gujrati	: Asgandha, Asundha, Asana ^[11]
Hindi	: Asgandh, Punir
Kannada	: Angaberu, Hirenaddina-Hire-gadday
Marathi	: Asgandha, Askagandha, Askandhatilli ^[12]
Oriyan	: Asugandha ^[3]
Persian	: Asgandh Nagori, Kaknjae Hindi
Sanskrit	: Ashvagandha, Gandhrapatni, Palashparni, Varahapatni, Turangi-gandh ^[10]
Telgu	: Pennerugadda, Asvagandhi, panneru
Tamil	: Amukkaram, Kizargu Amukkuran
Urdu	: Asgand Nagori

Unani description

Unani name	Asgand ^[7]
Botanical name	<i>Withania somnifera</i> (Linn.) Dunal ^[10] (Family: Solanaceae)
Synonyms	<i>Withania ashwagandha</i> Kaul ^[10] <i>Physalis flexuosa</i> Linn ^[13] .
Mizaj (Temperament)	Hot and dry in third degree ^[7, 14]
Maza	Mucilaginous, bitter and acrid ^[8]
Boo	Pungent odor, smell of horse's urine ^[7]
Nafae Khas	Muqawwie bah (Aphrodisiac) ^[7]
Parts used	Dried roots
Muzir (Adverse effect)	For throat, Person with hot temperament
Musleh (Corrective)	Gargle with <i>joshanda shehtoot shereen</i> for throat, <i>Kateera</i> and <i>roghan</i> for hot temperament person
Badal (Substitute)	<i>Qust</i> , <i>Suranjan</i> and <i>Behman safaid</i> ^[7]
Miqdare Khoorak (Dose)	3 to 5gm ^[7, 15] Up to 14gm ^[7]
Murakkabat (Compound formulation)	<i>Majoon muqawwie reham</i> , <i>Majoon zanjabeel</i> , <i>Habbe Asgand</i> , ^[3] <i>Maajoon suhaga</i> , ^[16] <i>Majoon salab</i> , <i>Majoon samag</i> , <i>Kushta godanti</i> , <i>Halwa gheekwar</i> , <i>Zimade muhallil</i> ^[17]
Afu'al (actions)	<i>Muqawwie reham</i> (Uterine tonic), ^[14] <i>Muqawwie aam</i> (General tonic), <i>Muhallile waram</i> (Anti inflammatory), <i>Muffatehe sudad</i> (Deobstruent), <i>Musakkin</i> (Relaxant), <i>Munawwim</i> (Sedative), <i>Moaddile Akhlat</i> (Normalize humours), <i>Mufattite hisaat</i> (Lithotriptic), <i>Moallide labn</i> (Galactagogue), <i>Musaffie khon</i> (Blood purifier) ^[7] <i>Moallide mani</i> (semen producer) ^[15]

Istemalat (Therapeutic Uses)

	Ailments	Approach
Genitourinary system	<i>Zofe bah</i> (sexual debility), <i>Jiryan mani</i> (spermatorrhoea), <i>Qillate mani</i> (oligospermia) and <i>Sailanur reham</i> (leucorrhoea). Infertility in woman <i>Kasrate tams</i> (menorrhagia) <i>Hissate gurda wa masana</i> (renal and vascular calculi) and <i>Taqtirul bou</i> (dribbling of urine)	Its powder along with milk is beneficial. It is given along with milk and sugar for 21 days it aids conception. Powder of <i>Asgand</i> 12gm with sugar is beneficial in. ⁷ Its powder along with milk is beneficial
Anti-inflammatory	Arthritis, Other inflammatory condition and cystic swelling ^[7, 14, 18] .	Local application as <i>tila</i> (a preparation by grapes water) It's warm leaves are applied which reduces inflammation.
Skin	To increases the complexion of skin ^[7, 19] .	Decoction made of 7 gm of <i>Asgand</i> and equal amount of <i>misri</i> (crystallized sugar) in milk given two times a day
Nervous system	It is good memory enhancer and reduces dementia ^[7, 19] .	Its powder along with milk is beneficial.
Cardiovascular system	It is useful in palpitation and shock ^[7] .	Its powder along with milk is beneficial.
Gastrointestinal system:	Blood purification <i>Bawasire khooni</i> (Bleeding piles)	It is grinded with chobchini (<i>Smilax glabra</i>) and taken with honey it cleanses impurities of blood. Fresh pieces of <i>Asgand</i> 250gm soaked in water for fortnight and used in the form of <i>zulal</i> , stops bleeding from haemorrhoids within 3 days ^[7, 19] .

Botanical Description

S. No.	Macroscopic description	<i>Withania somnifera</i> Dunal.
1	Habit	Under shrub
2	Stems and branches	Covered with minute star shaped hairs.
3	Roots	Stout, fleshy and have whitish brown surface but its internal surface is purely white. Outer surface of root have longitudinal wrinkles, it is surround by a knotty crown from which spring several shrubby round branches, 1-5 feet in length.
4	Leaves	Alternate, broadly ovate, sub-acute, entire margins
5	Inflorescence	Axillary, umbellate cymes
6	Flowers	Monococious greenish or yellow 1cm long
7	Calyx	Accrescent, gamosepalous with 5 sepals
8	Corolla	Campanulate, greenish-yellow with 5 petals
9	Androecium	Anthers 1.2 mm long, broadly ovate

10	Gynoecium	Ovary ovoid/globose, glabrous [20-22]
11	Style	Filiform, glabrous
12	Stigma	Mushroom-shaped, 2-lamellate
13	Fruit (Berry)	Fruits (berries) are smooth, orange-red when ripe, globose enclosed in the inflated and membranous calyx, 5 angled, pointed with the connivent calyx-teeth and scurfy-pubescent outside.
14	Seeds	Globose, enclosed in the persistent calyx, yellow, reniform
15	Flowering	Throughout the year [8, 20-22]

S. No.	Microscopic description	<i>Withania somnifera</i> Dunal.
1	Transverse section of root	Cork exfoliated or crushed when present isodimetric and non lignified; cork cambium 2-4 diffused rows of cells; secondary cortex about 20 layers of compact parenchymatous cell.
2	Phloem	Consist of sieve tubes companion cells
3	secondary xylem	Consist of hard forming a closed vascular ring separated by multiseriate medullary rays; a few xylem parenchyma [3, 20-22].

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 transval 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, anahygrine, tropine, pseudotropine and anaferine. There is another alkaloid called withosmine which is reported from the root of the plant grown in West Germany [6]. In addition to alkaloids the root are reported to contain starch, resin, fat, potassium nitrate, phytosterol, reducing sugars, hentriacontane glycosides, dulcitol, withanin, stearic, palmitic, 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, withanane, pseudo-withanine, somnine, somniferine [22, 23]. Withferin 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

Foreign organic matter	not more than 2%	
Ash values (%)	Total Ash	6.0
	Water soluble ash	3.0
	Acid insoluble ash	1.5
pH values	1% solution	5.5
	10% solution	5.5
Moisture content	Loss on drying at 105 ^o c	8.70%
Solid contents	91.30%	
Successive extractive values	Petroleum ether	0.348%
	Chloroform	0.304%
	Acetone	0.305%
	Alcohol	0.184%

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 [24].

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 *Withania somnifera* could be useful in the treatment of colon cancer [25].

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 gonadotropin 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 hydro-alcoholic 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 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 withamine, withaferinA, 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.

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