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## A REVIEW ON WITHANIA SOMNIFERA FOR ITS POTENTIAL PHARMACOLOGICAL ACTIONS

Rajkumar Mathur<sup>\*1</sup>, Dr. Amul Mishra<sup>2</sup>, Sazid Ali<sup>3</sup>

Faculty of Pharmacy, Maulana Azad University, Rajasthan, India,

Dept. of Pharm. Sciences, B.N. University, Rajasthan, India,

Dept. of Pharmacology, Jodhpur National University, Rajasthan, India.

Email: mathurrajkumar0@gmail.com

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### Abstract:

The herbal plants are used for treatment of various diseases because of their safety and effectiveness from ancient time. *Withania somnifera* is an important member of plant family Solanaceae. Commonly known as Ashwagandha. It is found in throughout the drier parts of South East Asia including India, Bangladesh, Sri-Lanka, Nepal, Pakistan, different parts of Australia, Africa and America. *Withania somnifera* is cultivated in many of the drier regions of India. In India, it is widely distributed in Madhya Pradesh, Uttar Pradesh, Punjab Gujarat and Rajasthan. Its roots, leaves, flowers, and pods contain carbohydrate, protein, aminoacids, steroids, flavonoids, alkaloids, tannins, phenolic compounds, oxalic acid, inorganic compounds, saponins and withanoloides. Pharmacological investigations have revealed the presence of several activities like antioxidant, antibacterial, analgesic, antipyretic, antiinflammatory, hypoglycemic, diuretic and hypo cholesterolemic, anxiolytic, antitumor activity, anticancer, antifungal, hypoglycaemic and hypolipidaemic activities. This article is an attempt to present the overview of pharmacognostical, phytochemical and pharmacological studies reported on *Withania somnifera*.

**Keywords:** *Withania somnifera*, Solanaceae, Phytochemistry, medicinal properties, pharmacological activities.

### Introduction:

Nature gave us numerous plants and a large number of chemical constituents can be isolated from plants from which we can fulfil the requirement of potent drugs.<sup>1</sup> *Withania Somnifera* (WS) is also known by some common names like

Ashwagandha, Indian Ginseng and Winter Cherry. It has been acting as an important Ayurvedic herb and indigenous medical systems from about 3000 years.

The word 'Ashwagandha' literally means 'the smell of horse'. There are two reasons existing, behind the name of the herb. 'Fresh roots of the herb emit the smell of horse' is the first reason while the second reason is 'it is believed that a person who is consuming extracts of this herb may be blessed with the strength and vitality which is similar like a horse.'<sup>2</sup>

In Ayurvedic medicine, this herb holds a central and prominent position. Because of its multifarious rejuvenative, Ashwagandha is also referred to as a "royal herb". This is a multipurpose herb which acts on various human body system: The immune system, the endocrinal system, the neurological system, the reproductive system and the energyproduction system.

The root section of this plant is categorized as rasayanas (famous for promoting health and longevity by enhancing defence activity against disease, arresting of the ageing process, revitalization of the body in debilitated conditions, enhancing the individual's capability of resisting adverse environmental factors and creating mental wellbeing sense).<sup>3</sup> It has been used from a very long time for all ages, both the sexes and also during pregnancy showing no side effects.<sup>4</sup>

Anxiety is a common emotional phenomenon which is a Central Nervous System Disorder in humans.<sup>5</sup> It is an emotional state which is unpleasant in nature and is accompanied by discomfort, uneasiness and fear or concern about some defined or undefined future threat.<sup>6</sup>

Considered to be a normal reaction to stress, anxiety is characterized by nausea, heart palpitations, fatigue and shortness of breath.

In psychopharmacology, anxiety has been playing an important area of research, in the current decade. It is also the most common mental illness which has affected about one eighth of the total population.<sup>7</sup> Referred to as a psychiatric disorder, anxiety has affected 25% of the population in adults at some point of their life. The anxiety disorders are noticed around 30.5% in women and 19.2% in men. In young people, the prevalence of this disorder is remarkably high. There is 15.4% prevalence rate of anxiety disorders in children of 7 to 11 years of age. According to a survey, there are less than 14% of people with such psychaitric disorder who receive treatment.<sup>8</sup>

There is use of a large number of plants in the treatment of anxiety disorders. *Withania Somnifera* is one among those plants. The traditional use of this plant include the treatment of antiarthritic, nervous and sexual disorders, nervine tonic, antispasmodic, sedative, anti-inflammatory, hypotensive, nerve soothing, free radical scavenger, antioxidant, immunomodulator, anti-cancer and anti-stress agent.<sup>9, 10</sup>

Prolonged exposure to this disorder can result in unbalance in the mental and physiological state of a person leading to other diseases like high blood pressure, metabolic disorders, depression, cardiac diseases, etc. Emerging as a major global disease, such conditions are rapidly increasing in prevalence.



**Fig.1: Withania Somnifera.**

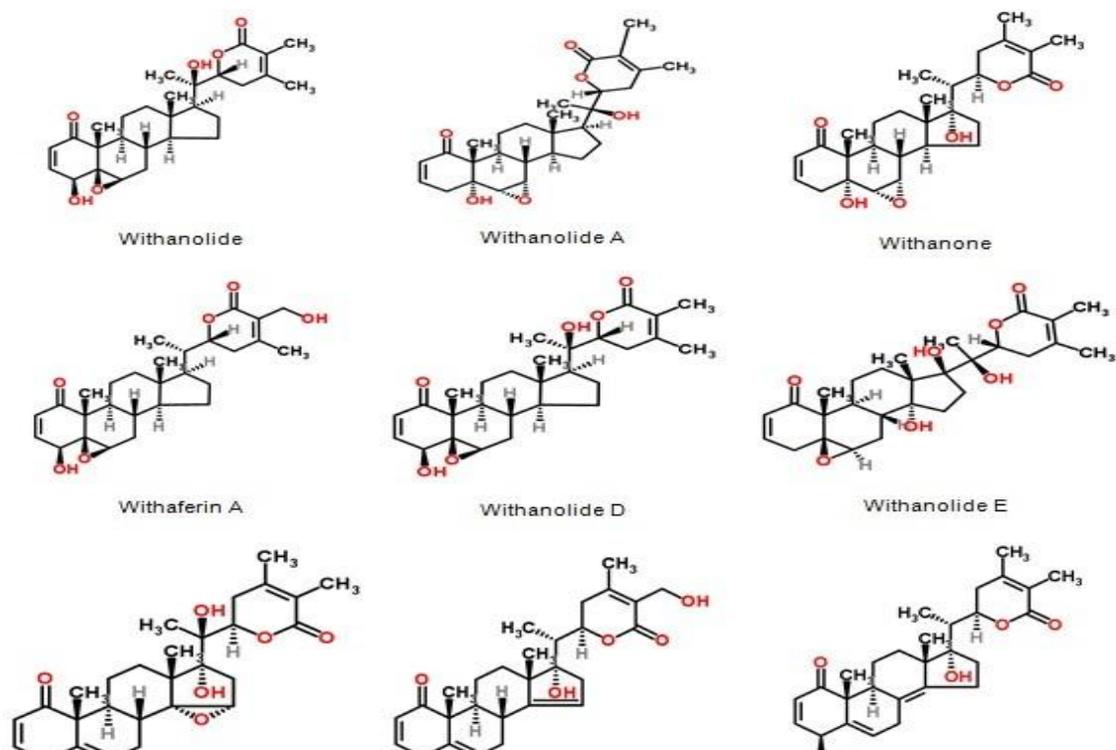
#### **GEOGRAPHICAL DISTRIBUTION OF WITHANIA SOMNIFERA:**

Ashwagandha is found in the drier parts of South East Asia (India, Bangladesh, Pakistan, Sri-Lanka, Nepal, different parts of Africa, Australia and America). In India, this herb is found in Punjab, Gujarat, Uttar Pradesh, Rajasthan and Madhya Pradesh.<sup>11, 12</sup>

#### **CHEMICAL CONSTITUENTS OF WITHANIA SOMNIFERA:**

Chemical constituents which are biologically active in this herb are protein, aminoacids, carbohydrate, steroids, alkaloids, oxalic acid, flavonoids, phenolic compounds, tannis, withanoloides, inorganic compounds and saponins.

<sup>11,13,14,15</sup>



## TAXONOMIC CLASSIFICATION

Kingdom : Plantae, Plants;  
 Subkingdom : Tracheobionta, Vascular plants;  
 Super division : Spermatophyta, Seeds plants;  
 Division : Angiosperma  
 Class : Dicotyledons  
 Order : Tubiorae  
 Family : Solanaceae  
 Genus : Withania  
 Species : somnifera

## BOTANICAL DESCRIPTION: SYNONYMS<sup>16</sup>

Gujarati - Asam, Asoda, Ghodasoda

Hindi - Asgandh

Canarese - Amangura,

Hirimaddina-gadde, Sogada-bery.

Marathi - Asgundh, Kanchuki, Askandha

Sanskrit - Ashvagandha, Balada, Gandhpatri, Kamrupini, Vajini

Bengali - Ashvagandh Punjabi-Asgand

Tamil - Asuragandi

Telugu - Asvagandhi, Penneru

Urdu - Asgandanagaori

## **PHARMACOLOGICAL ACTIONS:**

### **Anticancer activity:**

This plant has reported the anticancer activity. Over two thousand year, this plant has been used in the treatment of various kind of cancer diseases. Ashwagandha shows anticancer properties against lung, breast, prostate, pancreatic, colon, leukemia, head, renal and neck cancer cells of human beings. The anticancerous potential of *W. Somnifera* and its bioactive withanolides have been recently studied extensively by the various research groups present all over the world and have discovered many diverse mechanisms like cell differentiation induction, cytotoxicity, cyclooxygenase-2 (COX-2) inhibition, cancer chemoprevention and a potential which inhibits the enzyme quinone reductase. These withanolides chemical constituents are responsible for ashwagandha's biological properties including antitumor activity.<sup>17</sup>

### **Anti-inflammatory activity:**

The *Withania somnifera* plant was evaluated the anti-inflammatory activity of on carrageenin-induced paw oedema in rats. The sequential role of inflammatory mediators is proposed through inhibition of histamine, 5-hydroxytryptamine and prostaglandins as the antagonists. The time period for the release of inflammatory mediators in the anti-inflammatory activity of Ashwagandha is further suggested through reluctance of 5-HT and histamine (0-2hours) in early phase and prostaglandins (2-4 hours) in obstructed phase of inflammatory reaction in rats.<sup>14</sup>

### **Anti-microbial activities:**

*Withania somnifera* was also evaluated for anti-microbial activities of hydro-alcoholic extract of roots. In test organisms *E. coli* and *S. aureus*, antibacterial activity was evaluated. Results propound that the extract of *Withania*

Somnifera possesses significant anti-inflammatory activity, potent antioxidant activity and noteworthy anti-microbial activity against E. coli and S. aureus.<sup>18</sup>

**Antidiabetic activity:**

W. somnifera's roots were tested for diuretic, hypoglycemic and hypocholesterolemic effects on human subjects. Notable increase in urine volume, urine sodium, remarkable decrease in triglycerides, serum cholesterol, low density lipoproteins and very low density lipoproteins, cholesterol were detected which showed that W. somnifera's root is a potential source of diuretic, hypoglycemic and hypocholesterolemic agents.<sup>19</sup>

**Antioxidant activity:**

It is scrutinized that the antioxidant and hypocholesteremic effects of W. somnifera root powder in male albino rats. Significant decrease is registered in the administration of root powder(0.75 and 1.5 gm/rat/day) in the diet of the hypocholesteremic animals in cholesterol, lipids and triglycerides in plasma and additional notable decrease in lipid-peroxidation took place in W. somnifera administered hypocholesteremic animals when differentiated to their normal counterparts. Still, remarkable increases in plasma HDL-cholesterol levels, bile acid content of liver and HMG-CoA reductase activity were observed in these animals.<sup>20</sup>

**Diuretic activity:**

W. somnifera's leaf's aqueous extract was evaluated for diuretic activity in albino rats after detoxification with chloroform and defatting with petroleum. As standard drug, Frusemide was used. Thus, W. somnifera consequentially exhibited diuretic activity [may be due to presence of polar compounds in it].<sup>21</sup>

**Antianxiety activity:**

W. somnifera is evaluated for protective effect in sleep disturbed mice. Prearrangement with W. somnifera root extract (100.200mg/kg) and diazepam (0.5mg/kg) significantly secured reduction in body weight, improved locomotory activity and reduced anxiety levels in animals.

Likewise, a notable decrease in lipid peroxidation glutathione levels and improved catalase activity is shown by the biochemical studies. Initial results put forward that the root extract of W. somnifera can be utilized in the management of oxidative stress and sleep loss.<sup>22</sup>

### **Hepatoprotective activity:**

Investigation of the influence of *W. somnifera* root powder on the levels of urea, circulatory ammonia, lipid preoxidation products and liver marker enzymes for its hepatoprotective effect in ammonium chloride induced hyperammonemia was done by Harikrishnan *et al* (2008). A noteworthy increase in the levels of urea, transaminase, circulatory ammonia, aspartate, transaminase, alkaline phosphatase, alanine, thiobarbituric acid and hydroperoxides in experimental rats is shown by the treatment of ammonium chloride. In rats, treated with *W. somnifera* root powder and ammonium chloride, these changes were notably decreased indicating that *W. somnifera* promotes hepatoprotection by impacting the levels of lipid preoxidation by the companionship of withanolides, alkaloids, flavonoids etc.<sup>23</sup>

### **Anticonvulsant activity:**

The effect of *W. somnifera* root extract alone and in combination with exogenous GABA or with diazepam against pentylenetetrazol induced seizure threshold in mice was studied by Kulkarni SK *et al* (2008). The output advocated that the GABAergic modulation was considered to be involved in anticonvulsant effect of *W. somnifera*.<sup>24</sup>

### **Cardioprotective activity:**

The effect of *W. somnifera* in setting of ischemia and reperfusion (IR) injury in Wistar rats was described by Mohanty IR *et al* (2009). Significant apoptosis, necrosis, decline in antioxidant status and elevation in lipid preoxidation in the IR control group as compared to sham was the result of post-ischemic reperfusion injury. Myocardial oxidant-antioxidant balance was restored with *W. somnifera* prior-treatment. Ashwagandha's antioxidant and anti-apoptotic properties contributed to cardioprotective effects of ashwagandha.<sup>25</sup>

### **Antifertility activity:**

The study on role of stress in male fertility and the capability of *W. somnifera* to combat stress induced male infertility was done. Administration of root powder at a rate of 5 g/day for 3 months to test patients. The results disclosed that *W. somnifera* is effective in case of decreased stress, improved level of antioxidants and improved overall quality of semen in a remarkable number of individuals. Pregnancy in the partners of 14% of the patients was the result of this treatment.<sup>26</sup>

### **Antiepileptic activity:**

Traditional use of *W. somnifera* includes the treatment of epilepsy and seizures. Enough evidence for the use of *W. somnifera* against various types of epilepsy has been provided by *in vitro* and *in vivo* preclinical studies. Generally, studies in which rodents are the models show that *W. somnifera* is bioactive withanolide, effective in reducing seizures through various medicines. The Gama amino butyric acid (GABA)<sub>A</sub> receptor modulation mechanism was involved as one of the mechanism, in brain, where sub-effective dose of *W. somnifera* (50 mg/kg), with a sub-protective dose of either GABA (25 mg/kg) or Diazepam (0.5 mg/kg) increases the seizure threshold in brain.<sup>24</sup>

### **Anti-aging activity:**

For its anti-aging properties, Ashwagandha was tested in a double-blind clinical trial. The dosage of the herb was given to a group of 101 healthy males, 50-59 years old, 3 grams daily for one year. A significant improve in hemoglobin, red blood cell count, seated stature and hair melanin was experienced. Nail calcium was preserved and serum cholesterol was decreased. Improved sexual performance was reported in seventy percent of the research subjects.<sup>27</sup>

### **Hypothyroid activity:**

‘Ashwagandha may have an effect on thyroid activity’ was shown by animal studies. A mice was given an aqueous extract of dried *Withania* root for 20 days daily. A notable increase in serum T4 was spotted which indicates that the plant has a vitalizing effect at the glandular level. Via its effect on cellular antioxidant systems, *Withania Somnifera* may also tonic thyroid activity, indirectly. ‘Ashwagandha may be a useful botanical in treating hypothyroidism’ was indicated by the results.<sup>28, 29</sup>

### **Antiparkinsonian properties:**

A neurodegenerative disease characterized by the selective loss of dopamine (DA) neurons of the substantia nigrapars compacta is known as Parkinson’s disease. As an animal model for screening drugs for Parkinson’s disease, Neuroleptic-induced catalepsy has been used. Catalepsy in mice has been induced significantly by administration of haloperidol or reserpine. Haloperidol or reserpine-induced catalepsy has been significantly inhibited by WS and provide hope for treatment of Parkinson's disease.<sup>30</sup>

## Conclusion:

The detailed study on *Withania Somnifera*, an herbal medicinal plant, reveals that traditionally using this herb, since Vedic period to present days, is used in the treatment of many diseases. Nowadays, many investigations are carried out in the plants which indicate its multidisciplinary usage phytochemically and pharmacologically. *Withania Somnifera* is a very important plant for its large number of medicinal properties is seen from the literature. Therefore, many chemical constituents, present in *Withania Somnifera*, are responsible for their medicinal properties. Further extensive work is paved and reinforced by vits study so that a large number of biological activities can be identified which further can save mankind.

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**Corresponding Author:**

**Rajkumar Mathur\***,

**Email:** [mathurrajkumar0@gmail.com](mailto:mathurrajkumar0@gmail.com)