

# ***Withania somnifera: A Rejuvenating Ayurvedic Medicinal Herb for the Treatment of various Human ailments***

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**Abstract:** India is one of the 12 mega-diversity countries. It is estimated that around 70,000 plant species, approximately 7500 species have been recorded to have medicinal value. The 300 species are used by 7800 medicinal drug manufacturing units in India, which consume about 2000 tons of herbs annually. There are estimated to be more than 717,319 registered practitioners of *ayurveda*, *siddha*, *unani* and homeopathy in India and in recent years, the growing demand for herbal products has led to the extinction of many important plant herbs. Ashwagandha is also a rare and endangered plant. *Withania somnifera* possess good immunomodulatory anti-inflammatory, anti-tumor, antioxidant, anticancer properties and many pharmacologically and medicinally important chemicals, they protect the cells from oxidative damage and diseases. In present paper we have tried to unveil the therapeutic knowledge about Ashwagandha, which is used to exploit novel medicines. Considering its relevance, further research is required to explore the potential from this medicinal herb.

**Keywords:** *Withania somnifera*; immunomodulatory; anti-inflammatory; antioxidant; Withaferin A; alkaloids.

## **INTRODUCTION**

According to the World health organization, traditional medicines are widely used in India. Approximately 80% of the population of developing countries rely on traditional medicines for their primary health care needs<sup>1-3</sup>. Medicinal plants continue to play a central role in the health care system of large proportions of the world's populations. Recognition and development of the medicinal and economic benefits of these plants are on the increase in both developing and industrialised nations. The medicinal plants contain several phytochemicals such as Vitamins (A, C, E, and K), Carotenoids, Terpenoids, Flavonoids, Polyphenols, Alkaloids, Tannins, Saponins, Enzymes, and Minerals etc. These phytochemicals possess antioxidant activities, which can be used in the treatment of multiple ailments. Most often the medicinal plants are collected from the wild. This uncontrolled harvesting has resulted in the extinction of many plants and

created huge issues related to the potency and quality of medicinal products derived from these plants.

*Withania somnifera* (Family: Solanaceae) is a popular Indian medicinal plant and is also known as ashwagandha, ginseng, and winter cherry. It has been an important herb in the ayurvedic and indigenous medical system for over 3000 years. Numerous studies indicated that ashwagandha possesses antioxidant, antitumor, antistress, anti-inflammatory, immunomodulatory, hematopoetic, anti-ageing, anxiolytic, antidepressive rejuvenating properties and also influences various neurotransmitter receptors in the central nervous system<sup>4</sup>. In recent studies done on human breast, lung and colon cancer cell lines, plant extracts inhibited the growth of these cell lines. The researchers revealed that a specific extract from the plant, Withaferin A, was more effective in the inhibition than the common cancer chemotherapy drug, doxorubicin,

they used to compare it with<sup>5</sup>. Studies revealed that the anti-inflammatory and immunomodulatory properties of *Withania somnifera* (WS) root extracts are likely to contribute to the chemo preventive action<sup>6</sup>. The roots of the plant are categorised as rasayanas, which are reputed to promote health and longevity by augmenting defence against disease, arresting the ageing process, revitalising the body in debilitated

conditions, increasing the capability of the individual to resist adverse environmental factors and creating a sense of mental wellbeing<sup>7</sup>. It is in use for a very long time for all groups and both sexes and even during pregnancy without any side effects<sup>8</sup>.

In this review, we have attempted to summarize briefly the information available on the potency of WS because of its immense therapeutic potential.



**Figure1:** *W. Somnifera* in its fruiting stage



**Figure 2:** *Withania somnifera*



**Figure 3:** Roots of *Withania Somnifera*

## BOTANY AND DISTRIBUTION

*Withania somnifera* is a small, erect, evergreen woody under shrub belongs to Solanaceae family that grows or reaches about 30-150cm in height. *Withania somnifera* is known by various vernacular names i.e. In Hindi it is known as Asgandh; in English, Winter cherry; in Turangi, Gandha; in Bengali, Aswagandha; in Gujarati, Ghodakun & Ghoda; in Telgu, Vajigandha & Pulivendram, in Tamil, Amukkira; in Karnataka, Viremaddlinagadde; in Goa, Fatarfoda; in Punjabi, Asgand; in Malyalam, Amukkuram; in Kannada, Viremaddinagaddi; in Bombay, Asgund; in Rajasthani: Chirpotan.

This plant grows wildly in all drier parts of subtropical India i.e. in Madhya Pradesh, Uttar Pradesh, Punjab plains and North-western parts of India like Gujarat and Rajasthan. It is also found in Congo, South Africa, Egypt, Morocco, Jordan, Pakistan and Afganistan<sup>9</sup>. The fleshy roots when dry are cylindrical, gradually tapering down with a brownish white surface and pure white inside when broken. The roots are the main portions of the plant that are widely used as therapeutic agents. Leaves are simple, ovate, glabrous, 10 cm long, dense beneath and sparse above. Flowers inconspicuous, greenish or lubrid-yellow, in axillary, umbellate cymes; berries small, globose, orange-red when mature, enclosed in the persistent calyx; seed yellow, reniform. The bright red fruit is harvested in the late fall and seeds are dried for planting in the following spring.

## MEDICINAL USE

In Ayurveda, Ashwagandha is considered as a *rasayana* herb, which works on a nonspecific basis to increase health and longevity. *W. somnifera* has been in use for over 2500 years to treat all kind of diseases and human ailments<sup>10</sup>. This herb is also considered as an adaptogen which is a nontoxic herb that works on a nonspecific basis to normalize physiological function, working on the *HPA axis* and the neuro-endocrine system. The roots and berries of the plant are used in herbal medicine. In Ayurveda, the fresh roots are sometimes boiled in milk, prior to drying, in order to leach out undesirable constituents. The berries are used as a substitute for rennet, to coagulate milk in cheese making<sup>11</sup>. The species name *somnifera* means "sleep-bearing" in Latin, indicating it was considered a sedative, but it has been also used for sexual vitality and as an adaptogen.

In the traditional system of medicine Ayurveda, this plant is claimed to have potent aphrodisiac rejuvenative and life prolonging properties. It has general animating and regenerative qualities and is used among others for the treatment of nervous exhaustion, memory related conditions, insomnia, tiredness potency issues, skin problems and coughing.

It improves learning ability and memory capacity. The traditional use of 'Ashwagandha' was to increase energy, youthful vigour, endurance, strength, health, nurture the time elements of the body, increase vital fluids, muscle fat, blood, lymph, semen and cell production. It also helps to counteract chronic fatigue, weakness, dehydration, bone weakness, loose teeth, thirst, impotency, premature aging emaciation, debility, convalescence and muscle tension. It helps to invigorate the body by rejuvenating the reproductive organs, just as a tree is invigorated by feeding the roots<sup>12-15</sup>. Fruits, leaves and seeds of this plant have been traditionally used for the Ayurvedic system as aphrodisiacs, diuretics and for treating memory loss. The Japanese patent applications are related to the use of the herb as a skin ointment and for promoting reproductive fertility. In US, the New England Deaconess Hospital, has taken a patent on an Ashwagandha formulation claimed to alleviate symptoms associated with arthritis<sup>16</sup>. The product called "ashwagandha oil" is a combination of ashwagandha with almond oil and rose water designed to be used as a facial toner. Two acyl steryl glucosides, sitoindoside VII and sitoindoside VIII isolated from the roots of *Withania somnifera* were screened for putative antistress activity using a diverse spectrum of stressinduced paradigms. Two new Glycowithanolides, Sitoindoside IX (1) and Sitoindoside X (2) isolated from *Withania somnifera* were evaluated for their immunomodulatory and CNS effects (anti-stress, memory and learning)<sup>(3)</sup> It is said to have free radical scavenger activity (antioxidant activity) in *In vivo* model where it has increased superoxide dismutase and catalase activities of rat liver<sup>16</sup>. The active principles of *Withania somnifera* consisting of equimolar amounts of Sitoindosides VII and Withaferin A were investigated for putative nootropic activity in a experimentally validated Alzheimer's disease model. The syndrome was induced by ibotenic acid (IA) lesioning of the nucleus basalis magnocellularis in rats. *Withania somnifera* significantly reversed both IA induced cognitive deficit and the reduction in cholinergic markers after 2 weeks of treatment. These findings validate the Medharasayan (promoter of learning and memory) effect of *Withania somnifera* as has been reported in Ayurveda<sup>17</sup>. Studies of ashwagandha showed that an acetone extract of alkaloids caused mild CNS depression in dogs and mice and protected against supramaximal electroshock seizures in rats. The extract caused hypothermia in mice and potentiated hypnosis induced by barbiturates, ethanol and urethane<sup>18</sup>.

Root of *Withania somnifera* used for the treatment of asthma, bronchitis, edema, leucoderma, anorexia, consumption, asthenia, anemia, exhaustion, aging,

insomnia, ADD/ADHD, neurasthenia, infertility, impotence, repeated miscarriage, paralysis, memory loss, multiple sclerosis, immune-dysfunction, carcinoma, rheumatism, arthritis, lumbago<sup>19-23</sup>. Leaves have been used internally for fever and haemorrhoids; externally for wounds, haemorrhoids, tumours, tuberculosis glands, anthrax pustules, syphilitic sores, erysipelas, and in ophthalmitis<sup>22,23</sup>. Fruits are used externally in ringworm<sup>22</sup>.

A methanolic & 80% ethanolic extract of *Withania somnifera* displayed significant anti-inflammatory activity on carrageenan-induced paw edema<sup>24</sup>. The root extract of Ashwagandha prevented the rise of experimentally induced LPO in rabbits & mice<sup>25</sup>. Withaferin A and Sitoindosider VIII-X exhibits fairly potent anti-arthritis, anti-inflammatory, antioxidant & immuno modulant activities, they also increase in the levels of SOD, CAT, GPX in brain & the steroid lactone W.A<sup>26</sup>. Withaferin A, also showed significant antitumor & radiosensitizing effects in experimental tumors without any toxicity & inhibiting tumor growth increasing survival in swiss albino mice inoculated with Ehrlich ascites (ESC) carcinoma<sup>27-29</sup>.

The administration of Ashwagandha Rasayana significantly reduced the lung tumor nodule formation and also reduced leucopenia induced by cyclophosphamide treated experimental animals, indicating its usefulness in cancer therapy<sup>30,31</sup>. *Withania* increase the WBC count, reduce leucopenia. They also increased bone marrow cellularity & normalised the ratio of hormachromatic erythrocytes & polychromatic erythrocytes<sup>31</sup>.

## CHEMICAL CONSTITUENTS

The plant is chemically very complex and more than 80 compounds are known from it<sup>32</sup>. The biologically active chemical constituents are alkaloids (ashwagandhine, cuscohygrine, anahygrine, tropine etc), steroid compounds, including ergostane type steroidallactones, withaferin A, withanolides A-y, withasomniferin-A, withasomnidienone, withasomniferols A-C, withsommiferin A, withasomnidienone, withasomniferols A-C, withanone etc. The constituents of *Withania* roots are the steroid alkaloids and steroid lactones. They belong to a class of constituents called the withanolides<sup>33,34</sup>, with the main active chemical constituent Withaferin A, a phytosteroid<sup>35</sup>. Other constituents include saponins containing an additional acyl group (sitoindoside VII and VIII), and withanolides with a glucose at carbon 27 (sitoindoside ix and x)<sup>33,36</sup>. Apart from these contents plant also contain chemical

constituents like withanol, acylsteryl glucosides, starch, reducing sugar, hantreacotane, ducitol, a variety of amino acid including aspartic acid, proline, tyrosine, alanine, glycine, glutamic acid, cystine, tryptophan, and high amount of iron.

*Withania somnifera* has chemo genetic variation and so far three chemotype I, II and III had been reported<sup>37</sup>. In Indian variety thirteen Dragendorff positive alkaloids have been obtained.

The reported alkaloids are anaferine [bis (2-piperidylmethyl) ketone]; isopelletierine; tropine; pseudotropine; 3 $\alpha$ -tigloyloxtropine; 3-tropyltiglate; cuscohygrine; dl-isopelletierine; anahygrine; hygrine; mesoanaferine; choline; somniferine; withanine; withananine; hentricontane; visamine; withasomine, a pyrazole derivative from west Germany; pseudowithanine and ashwagandhine. Withanol (mixture of withanolides) and number of withanolides including withaferine-A; withanolide N and O; withanolide D; withanolide p and 8; withanolide Q and R; withanolide y, 14 $\alpha$ -hydroxyl steroids and withanolides G, H, I, J, K and U<sup>38</sup>. Seven new withanolide glycosides called withanosides I, II, III, IV, V, VI and VII had been isolated and identified<sup>39</sup>. Much of Ws pharmacological activity has been attributed to two main withanolides, withaferin A and withanolide D.

## CONCLUSION

Medicinal plants maintain the health & vitality of individuals & also cure disease, without causing toxicity. As *Withania somnifera* possess good immunomodulatory anti-inflammatory, antitumor, antioxidant, anticancer properties and many pharmacologically and medicinally important chemicals, such as Withaferins, sitoindosides and various alkaloids, they protect the cells from oxidative damage and diseases. Thus consume a good diet, rich in antioxidant plant foods (eg. Fruits and vegetables) will provide health- protective effects. In conclusion, this article provides the therapeutic knowledge about *Withania somnifera*, which is used by the people all over the world. Also, it is of significance to exploit novel medicines from *Withania somnifera*. Although, the results from this review are quite promising for the use of this plant as a multi-purpose medicinal agent.

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