

MIRACLE AYURVEDIC HERB - ASHWAGANDHA (WITHANIA SOMNIFERA DUNAL)

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ABSTRACT

Ayurveda is successfully implemented as a primary healthcare system in India, and it is flourishing in the promotion of health around the world. Ayurveda aims to create a society happily, healthy, and peaceful. In general, the simple regimes mentioned in Ayurveda texts are of immense use faced by the present world today regarding health promotion. *Ashwagandha* (*Withania Somnifera*) is usually referred to as 'Indian winter cherry' or 'Indian Ginseng'. It is a shrub grown in India and North America whose roots have been used by Ayurvedic practitioners for thousands of years. Ashwagandha is one of Ayurveda's most essential herbs, used as Rasayana for its wide range of health benefits for centuries. **Chemicals constitute of Ashwagandha** (*Withania Somnifera*)- The chemistry of *Ashwagandha* (*Withania Somnifera*) has been widely studied and numerous categories of chemical constituents have been described, extracted, and isolated, such as steroidal lactones, alkaloids, flavonoids, tannin, etc. More than 12 alkaloids, 40 withanolides and several sitoindosides have currently been isolated from the aerial parts, roots, and berries of the *Withania* species and have been recorded. The principal biochemical element of *Ashwagandha* (*WS*) root is withanolides, which are steroidal alkaloids and steroidal lactones. **The pharmacological activity of Ashwagandha**- It has been shown to have pharmacological importance as an Adaptogen, Antibiotic, abortifacient, aphrodisiac, Astringent, Anti-inflammatory, deobstructive, diuretic, narcotic, sedative, and tonic through centuries of Ayurvedic medicinal practice using Ashwagandha (*Withania Somnifera*). Along with these Ashwagandha acts as Anti-stress,

Anticarcinogenic activity, Anti-inflammatory activity, Anti-aging activity, Cardioprotective activity, hypothyroid activity and Immunomodulatory activity.

Keywords: *Ashwagandha*, *Withania Somnifera*, Alkaloids, Withanoids, sitoindosides

INTRODUCTION

In traditional Indian systems of medicine, *Withania Somnifera Dunal* (*Solanaceae*), also known as *Ashwagandha* or winter cherry, is one of the most important plants. It is a small evergreen shrub with a height of approximately four to five feet. In India, it is cultivated in the Madhya Pradesh, Uttar Pradesh, Punjab, Gujarat, and Rajasthan states on a commercial scale. In Ayurveda, Unani and Siddha, this plant is used in more than 200 formulations. One of the prime drugs of *Ashwagandha* is *Medica Ayurveda Material*. It was included in *Balya* and *Brimhanagana* by Acharya Charaka. *Balya*, *Vrishya* and *Rasayana* are attributed to the Properties and recommended as a substitute for Kakoli and Kshirakakoli.¹ The name *somnifera* means 'sleep inducing' in Latin, suggesting that sedating properties are attributed to it, but it has also been attributed to it. Used as an adaptogen and used for sexual vitality. *Ashwagandha* is referred to by some herbalists as Indian ginseng, as it is used in Ayurvedic medicine in a way like that used in traditional Chinese medicine. The Decoction of the roots is used for colds and chills in an ethnomedicinal manner and to increase the tone of the uterus after miscarriage or birth. For asthma, an

infusion of the root bark has been used a use also common with traditional India's herbal practises.²

Its root is used in Ayurvedic medicine as an anti-inflammatory treatment for Swellings, cancers, rheumatism and scrofula, and in anxiety neurosis, as a sedative and hypnotic. The leaf has anti-inflammatory properties, Hepato-protective properties of antibacterial. Fruits and seeds have diuretic properties. The berries are used in cheese making as a substitute for rennet, to coagulate milk. Studies have shown that the activity of the extract of *Withania* was roughly equal to that of the extract of *Panax ginseng*. However, *Withania somnifera* has an advantage over *Panax ginseng* in that it does not seem to contribute to ginseng abuse syndrome, a disease of High blood pressure, water retention, muscle pain, and insomnia are characterised.³ Huge numbers of experimental and clinical studies performed on *Ashwagandha* are screened on different biological systems for their protection and effectiveness, but their information is scattered. Many review papers are also constructed, but most of them are only based on pharmacological and pharmacological (in vivo or in vivo) In vitro) profile profiles.

Table 1: Indication described in Ayurvedic Medicine⁴ -

Murchha (syncope)	Apasmara (epilepsy)
Shosha(cachexia)	Unmada (mania/psychosis)
Karshya (emaciation)	Arsha (piles)
Pramehapidika (diabetic carbuncle)	Arbuda (tumour)
Gandamala (cervical lymphadenitis)	Bhagandara (fistula-in-ano)
Guhya Vrana (ulcer in genitalia)	Vatarakta (gout)
Kushtha (diseases of the skin)	Kilasa (vitiligo)
Yonidosha (disorders of female genital tract)	Katigraha (stiffness in lumbosacral region)
Gridhrasi (sciatica)	Hanugraha (lockjaw)
Janustabdhata (stiffness of the knee)	Hrudgraha (cardiac failure)
Asthibhanga (bone fracture)	Vidradhi (abscess)

Table 2: Ashwagandha Formulations⁵ –

<i>Shwagandhadi Churna</i>	<i>Ashwagandha Rasayana</i>
<i>Ashwagandha Ghrita</i>	<i>Ashwagandharishta</i>
<i>Ashwagandha Taila</i>	<i>Madhyamanarayana Taila</i>
<i>Brihat Ashwagandha Ghrita</i>	<i>Brihachchhagaladyaghrita</i>
<i>Saraswata Churna</i>	<i>Pramehamihira Taila</i>
<i>Nagabala Ghrita</i>	<i>Madhusnuhi Rasayana</i>

Table 3: Taxonomical classification⁶-

Kingdom- Plantae	Subkingdom- Tracheobionta
Superdivision- Spermatophyta	Division- Angiosperma
Class- Mangnoliopsida- Dicotyledons	Subclass- Ateridae
Order- Tubiorae/ Solanales	Family- Solanaceae
Genus- Withania	Species- Withania Somnifera (L.) Dunal

Rasa Panchaka-

Rasa- Katu, Tikta Rasa, Guna- Laghu, Virya- Ushna
Virya, Vipaka- Madhura

Geographical Distribution-Widespread in semiarid environments from the Mediterranean coast to Indian.

Description ^{7,8}-

A woody shrub, growing from a long, tuber out tap-root, stellateomentose, up to 2 m in height.

Leaf- Simple, 2-11 cm in length, 1.5-9.0 cm in width, exstipulate, 6-20 mm long petiole, elliptical to the ovate-lanceolate blade, acute or rounded apex, acute to long decurrent base, 8-10 cm long and alternate vegetative shoots, 3-8 cm long and opposite reproductive shoots, arranged in pairs of one wide and smaller leaf, whole or wavy margin.

Inflorescence- Axillary, 2-25 yellow green, shot-pedicellate flowers, umbellate cyme. Perfect, radially symmetrical, campanulate, calyx with 5 acute triangular lobes, corolla twice the length of the calyx, 7-8 mm long, with 5 spreading or reflexed lanceolate lobes, stamen 5, slightly exerted, alternating filaments with petal lobes, partially fused with the corolla, superior, glorious, stigma bifid.

Fruit- Berry, globose, 5-6 mm in diameter, orange-red, closed in green, membranous, calyx-inflated, 2.5 cm in diameter, roughly, and 5 angled slightly.

Seeds- Many, discoid, 2.5 mm pale yellow in diameter.

Dried Root-

General appearance- Straight and unbranched, the thickness varying with age. The main roots bear fibre like secondary roots. The outer surface of the root is buff to grey, yellow with longitudinal wrinkled. The crown consists of 2-6 remains of the stem base. The base of the stem is green, variously thickened, cylindrical, and longitudinally wrinkled. The roots break with short uneven fracture.

Organoleptic Properties-

Odour- Characteristic, horse-like.

Taste – Sweetish, yet bitter and astringent and slightly mucilaginous.

Microscopic Characteristics- The transverse section shows an exfoliated or crushed narrow band of yellowish cork, a narrow cortex filled with starch grains, a cork cambium of 2-4 diffused rows of cells, a secondary cortex of around 24 layers of compact parenchymatous cells, phloem consisting of a sieve tube, a corresponding cell, secondary hard xylem, forming a closed vascular ring separated by multiserial medullary rays, a few xylems parenchyma cells.

Powdered material - Thin cork walled, lignified, cubic or elongated cells, often indistinct and collapsed, with yellowish-brown contents, 2-3 cells deep in smaller roots up to 16 in larger primary roots, dusty white or grey to yellow-brown. Cortex parenchyma is composed of large thin-walled cells filled with starch granules, and sometimes containing calcium oxalate microspenoidal crystals, Xylem elements are either

tracheidal with bordered pits or more rarely, thickened reticulate vessels, thickened lignified walls and simple pits of xylem fibre. Abundant, simple or 2-4 compound starch, with a labelled, irregularly shaped hilum.

Cultivation and Economics- It was estimated that about 2000 tons of Ashwagandha roots were produced annually in India, but the requirement was estimated at 7000 tonnes. Because of its popularity due to large-scale unrestricted exploitation, the need for *Withania somnifera* has increased sharply. As a result of the depletion of this medically important plant species from its natural habitat, it is now included in the International Union for the Conservation of Nature and Natural Resources list of threatened species.⁹

Withania Somnifera grows well with good drainage at pH 8.0 in sandy loam or light red soil. It can be cultivated at altitudes of between 600-1200 m. The semi-tropical regions receiving rainfall of 500-750 mm are ideal for the cultivation of this rainy crop. During its growth period, the crop needs a dry season. The temperature that is most suitable for cultivation is between 20°C and 35°C. Late winter rains are useful for the proper growth of the plant roots.¹⁰

Phyto-chemistry- Given the medicinal significance and the wide application of *Withania Somnifera* as a therapeutic agent, the apparent potential of *Withania Somnifera* as a positive health promoter in the global market is well established, which in turn has attracted the interest of various phytochemist's. Consequently, the chemistry of *Withania Somnifera* has been extensively studied, leading to the isolation and characterization of many classes of biologically and pharmacologically important chemical constituents. Alkaloids, steroidal compounds and ergostane and steroidal lactones are the biologically active chemical constituents (withaferin A, withanolides A-Y, withanone etc). Saponins containing additional acyl groups (sitoindosides IX and X) and withanolide glycosides called withanosides I to VII are additional constituents.^{11,12,13,14,15,16, 17} More than 12 alkaloids, 40 withanolides and several sitoindosides have currently been isolated and reported from aerial components, roots, and berries of the *Withania* species (Mirjalili et al., 2009). In addition, several

other secondary metabolites are borne by the plant, including flavonol glycosides, sterols, phenolics, chemical components such as withaniol, acylsteryl glucosides, starch, sugar reduction, hantreacotane, ducitol, a variety of amino acids including aspartic acid, proline tyrosine, alanine, glycine, glutamic acid, cystine, tryptophan and high iron content.¹⁸

Alkaloids- The medicinal properties of the root are due to many alkaloids being present. Eight brown alkaloids were identified in primary studies, the main alkaloid being "withanine" which showed sedative and hypnotic action.^{19,20}

Later, the presence of several biochemically heterogeneous alkaloids was confirmed by chromatographic analysis of the root extract. Thirteen positive Dragendorff alkaloids were obtained from the Indian variety. Cuscohygrine; disopelletierine; anahygrine; choline; soniferine; withanine; anaferine; isopelletierine; tropine; pseudotropine; 3 alpha-tigloyloxatropine; 3 alpha-tropyloxyloate; hygrine; mesoanaferine; withanine; hentriacontane; visamine; pyrazole derivative withasomnine; pseudowithanine and ashwagandine are the alkaloids identified.^{21,22,23} However the alkaloids of *Withania Somnifera* were not individually found to have any unique biological or pharmacological actions. The total alkaloid content of Indian chemotype roots ranges between 0.13% to 0.31%.^{24,25}

Withanolides- The chemical constituents of *Withania Somnifera*, especially noticeable in the leaves, are marked by a great deal of variability. This variability is marked by the inclusion of the withanolide group of differently substituted steroidal lactones. A group of compounds characterised by a C28 basic steroidal skeleton with a side chain of nine carbon atoms in which C-22 and C-26 are properly oxidised to form a six-membered δ -lactone ring was given the name 'Withanolide.' A 22-hydroxyergostan-26-oic acid-26, 22-lactone can be described as the withanolide skeleton.^{26,27}

As a general function of the molecule, a 1-keto-to-2-system, located in ring A, was observed. From the biogenetic point of view, withanolides can be regarded as having a structure of the cholestane form with an

extra methyl group at C-24 and with different oxygenated or double bonds located at different skeleton sites.²⁸

There are several novel structure variants of withanolides with either carbocyclic skeleton or side chain modifications and these have also been identified as withanolides-related modified withanolides or egostane-type steroids. These compounds are usually polyoxygenated, and an enzyme mechanism capable of oxidising all carbon atoms in a steroid nucleus is assumed to be in the plant that produces them. The characteristic feature in the C8 or C9-side chain of withanolides and ergostane-type steroids with a lactone or lacteal ring but the lactone ring can be either six-membered or five-membered and can be fused through a carbon-carbon bond or an oxygen bridge with the carbocyclic portion of the molecule. Appropriate oxygen substituents can lead to bond splitting, new bond-forming, ring aromatization and many other forms of rearrangements, resulting in compounds with new structures. Around 40 steroidal lactones from different parts of *Withania Somnifera* have been identified. Four unusual withanolides (16-en-27-deoxywithaferin-A; 2,3-dihydro-3 β -hydroxy withanone; 27-acetoxy-3-oxo-witha-1,4,24-trienolide; 2,3-dihydroxy-3 β -O-sulfate) were isolated and characterised by Misra et al. (2005) along with six known withanolides (24,25-dihydroxythanolide A; withanolide A; withanone; withaferin A; 27-hydroxywithanone; and 17-hydroxy withaferin A from *Withania Somaferin* A leaves. Further research has led to the isolation of two new and seven known root withanolides and five new Withanolide from *Withania somnifera* stem bark, namely withasomnilide, withasomniferanolide, somniferanolide, somniferawithanolide and somniwithanolide.^{29,30}

Withanolide biogenesis appears to be highly restricted to a few genera and the largest number of withanolides are developed by *Withania Somnifera* in diversified functional groups and regio/stereo forms, some of which have unique therapeutic significance. Withanolides are subdivided according to their structural characteristics as a) un-substituted compounds at Withanolide E. Development of Withanolide differs

from plant to plant. In (1965), Lavie and his associates described five well-defined chemotypes of this plant that grow in various locations in Israel, India and South Africa, i.e. morphologically similar, but differing in their leaf withanolide material.³¹

In Indian varieties of *Withania Somnifera*, described two chemo-types. The main Indian chemotype-I steroidal lactone is withanone and Withaferin A, both of which contain 5 α -hydroxy-6 α , 7 α -epoxy grouping the ability of different chemotypes to produce withanolides with different patterns of nuclear replacement is genetically regulated and withanolides are produced either with new nuclear replacement depending on the genotype of the parents or entirely new withanolides not present in the parents. Some of the plant's important withanolides are withaferin A, withanone, withanolide D and withanolide A. Two primary withanolides have been linked to much of the pharmacological function of *Withania somnifera*: withaferin A and withanolide D. These secondary triterpenoid ancestry metabolites occur mainly in *Withania Somnifera* leaves and roots, but with major variations in their ratio for Ex. Withaferin A is found primarily in leaves, while withanolide D is found primarily in roots. Withanolides have mostly been found in members of the solanaceae plant family i.e. *Datura*, *Deprea*, *Dunalis*, *Iochroma*, *Discopodium*, *Trechonaetes*, *Physalis*, *Salpichroa*, *Withania*, *Witheringia*, *Jaborosa*, *Lycium*, *Nicandra*, *Tubocapsicum*, *Acnistus*. Other species of this genus, besides *Withania somnifera*, include *W. coagulans*, *W. aristata* and *W. frutescens* are known to produce withanolides.^{32,33}

Withaferin A- One of the main withanodal active principles extracted from the plant to which the curative properties of the leaves are related is withaferin A, chemically characterized as (4 β , 5 β , 6 β , 22R)-5,6-Epoxy-4,22,27-trihydroxy-1-oxoergosta-2,24-dien-26-oic acid δ -lactone. Remarkable bacteristic, anti-tumor, anti-arthritic and anti-inflammatory activities are confirmed to have been reported.³⁴ Due to its ability to arrest dividing cells at metaphase, Withaferin A serves as a cancer inhibitor. Inhibitory growth activity against a variety of cancerous cell lines such as KB, Sarcoma 180 and carcinoma of Ehrlich ascites has

been shown It also has radio-sensitizing effects on tumours and cancer. Recently, due to the existence of unsaturated lactone rings, this highly oxygenated steroidal lactone has been reported to have potent anti-angiogenic activity. Opening the lactone ring or saturating the double bond by alkaline hydrolysis causes the loss of activity.³⁵ It inhibits cyclooxygenase-2 (COX-2) but not cyclooxygenase-1 (COX-1), which is necessary for a chemotherapeutic/non-ulcerative anti-inflammatory drug. Immunosuppressive activity on B-lymphocyte proliferation has also been noted. Withaferin A yields 0.18 per cent in Indian plants on an air-dry basis, while South African varieties produce 0.86 per cent of the compound. Performed TLC densitometry quantitative analysis of Indian chemotypes of *Withania Somnifera* and found that withaferin-A was completely absent in the roots, stems, seeds and persistent calyx of intact plant fruits, except in leaves (1.6 per cent). Withaferin A was also observed in roots later with advanced analytical methods, but its concentration in roots was much less compared to leaves.^{36,37}

Classical applications of Ashwagandha (*Withania Somnifera*)^{38,39}- Ashwagandha receives the unique name as root smells like horse (Ashwa) and it is believed that it provides the strength of a horse on guzzling. Different parts of Ashwagandha have significant therapeutic effects, either as a whole plant extract or as separate constituents. When fresh powder from the plant is used the best outcomes occur.

Ashwagandha root is very useful for its effective narcotic, diuretic, tonic, aphrodisiac, anthelmintic, astringent, tumour antiangiogenic, antimutagenic, thermogenic and stimulant properties. Roots are equally effective against constipation, weakness, goitre, rheumatoid, vitiated leucoderma conditions, insomnia and nervous disorders, lead-induced DNA damage, etc.

Ashwagandha root paste effectively reduces the occurrence of asthma, arthritis, rheumatoid arthritis, osteoarthritis, carbuncles, ulcers, leucorrhoea, boils, pimples, flatulent colic, piles, and painful swelling when applied locally as an anti-arthritic agent.

Antioxidant property^{40,41}- Several studies have shown that Ashwagandha can be used as a natural source of healthy antioxidant agents. *Withania Somnifera* acts as a potent antioxidant and increases the levels of three natural antioxidant enzymes such as superoxide dismutase, catalase, and glutathione peroxidase. Likewise, oral administration of *Withania Somnifera*. A rise in lipid peroxidation in mice and rabbits was prevented by Somnifera extract. The activity of Withania in antioxidants. Somnifera has been shown in mice and withanolides, glycowithanolides and VII-XX sitoindosides were suggested to be imparted. In people treated with Withania, a substantial increase in haemoglobin, red blood cell count, hair melanin and reduced serum cholesterol was observed.

Since they are rich in lipids and iron, the brain and nervous system are comparatively more vulnerable to free radical damage than other tissues, both known to encourage the generation of reactive oxygen species. In cerebral ischemia, free radical nervous tissue damage can be responsible for neuronal loss and may be implicated in ageing and neurodegenerative disorders, such as epilepsy, schizophrenia, Parkinson's, Alzheimer's and other diseases. The active tenets of Withania increase in levels of endogenous superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPX) and ascorbic acid are recorded for somnifera, sitoindosides VII-X and withaferin A (glycowithanolides), with a concomitant decrease in lipid peroxidation. The active principle of *Withania Somnifera* a root has antioxidant effects like Anti-stress, cognition facilitating, anti-inflammatory and anti-ageing effects.

Anti-cancer activity^{42,43}- Important anti-tumour and radio-sensitizing withanolides are stated to be withaferin A and withanolide D. Another constituent of W. is 1-oxo-5 β , 6 β -epoxy-witha-2-enolide. Somnifera has been reported to minimise UV-induced skin carcinoma. Withaferin A functions as a mitotic poison that arrests the metaphase division of the cultured cells of human larynx carcinoma. A major dose-dependent delay in the growth of Ehrlich ascites carcinoma, sarcoma 180, and sarcoma Black and E 0771 mammary adenocarcinoma has also occurred. Methanolic extract of *Withania Somnifera* has been used to proliferate

stem cells. It also decreases breast, lung, central nervous system and colon cancer cell lines by reducing their viability in twelve dependent ways and therefore holds promise as a chemotherapeutic agent. Withaferin A-mediated breast cancer cell viability suppression correlated with the induction of apoptosis characterized by DNA condensation, DNA fragmentation associated with cytoplasmic histone, and poly (ADP-ribose)-polymerase cleavage. Chemo-preventive activity is due in part to the extract's antioxidant/free radical scavenging activity. Alteration of the cytoskeleton architecture by covalently binding an nexin II, anti-tumour potential by inhibition of pro-theasomal chymotrypsin-like activity and induction of apoptosis by inhibition of protein kinase C or activation of caspase-3 has also been investigated. These findings indicate anti-tumour activity as well as enhancing the effects of radiation.

Anti-inflammatory properties^{44,45}- Ashwagandha works by supplement inhibition, lymphocyte proliferation, and delayed type hypersensitivity as an anti-inflammatory agent. In several rheumatological disorders, *Withania Somnifera* extracts have shown anti-inflammatory effects. The extract was found to reduce the content of glycosaminoglycans in granuloma tissue by almost 100% and to decouple oxidative phosphorylation by significantly reducing the ADP/O ratio in granuloma tissue mitochondria and increasing the activity of the Mg²⁺ dependent-ATPase enzyme and subsequently reducing the activity of succinate dehydrogenase in granuloma tissue mitochondria. Studies indicate that inhibition of cyclooxygenase could be involved in the mechanism of action of *Withania Somnifera*.

Anti-microbial activities⁴⁶- For the first time, the antibacterial properties of this multipronged medicinal plant were documented against *Salmonella aurens*. Antimicrobial activity against a variety of bacteria and fungi assigned to withanolide has been documented over the past decade. However, current literature indicates that to explore its potential in the treatment of other infectious diseases as well this herb should be studied more extensively.

Anti-arthritic properties⁴⁷- In acute rheumatoid arthritis, Ashwagandha powder has been found useful and reduces the pain associated with arthritis. The active ingredient withaferin A was attributed to this property.

Anti-stress and Aphrodisiac activity⁴⁸- Bhattacharya has documented anti-stress activity associated with glycosides (sitoindosides VII and VIII) present in this plant (1987; 2000 & 2003). (1987; 2000 & 2003). The research conducted supported the utility of Ashwagandha as an adaptogen against antistress. In the treatment of spermatopathy, impotence and seminal depletion, Ashwagandha is also used as a tonic and men who used the herb enjoyed higher vigour output. The higher concentrations in the roots of this plant of in-organic elements such as Fe, Mg, K and Ni play an important role in the drug's diuretic and aphrodisiac function. For the healing of sterility in women, root decoction boiled with milk and ghee is recommended.

Effect on cardiovascular system⁴⁹- Assessment of the hypoglycemic as well as diuretic and hypo-cholesterolemic effects of Ashwagandha root in humans revealed that the treatment of subjects with type 2 diabetes and mildly hypercholesterolemic can be initiated with a powder extract for 30 days, resulting in a reduced in blood glucose level comparable to that of oral hypoglycemic medication. Significant increases have also been observed in serum cholesterol and triglycerides and low-density lipoproteins.

Cardiovascular Protection⁵⁰- The *Withania Somnifera* extracts are associated with hypotensive effects due to autonomic ganglion blocking action as well as a depressant action on the higher cerebral centres. *Withania Somnifera* has recently been verified as a cardioprotective agent, offering a scientific basis for the use of this medicinal plant as *Maharasayana* in Ayurveda.

Effect on nervous system^{51,52}- Ashwagandha is said to have the central nervous system sedative rather than stimulatory action, making it a superior nervous irritability drug in fatigue. The concentration of neurotransmitters, believed to play an important role in brain functions such as memory, is altered by Ashwagandha. The effects of Ashwagandholine are correlated with

the nervous system (root extracts). It encourages barbiturate, ethanol and urethane-induced hypnosis in mice and has caused relaxant and antispasmodic effects in the intestinal, uterine, tracheal and vascular muscles against various agents that create smooth muscle contractions. The bioactive compounds are reported to affect the events in the cholinergic-signal transduction cascade of the cortical and basal forebrain preferentially. The effects of *Withania Somnifera* extracts on cognition and memory can be partially explained by the drug-induced improvement of the capacity of the cortical muscarinic acetylcholine receptor. Ashwagandha has been historically used as a tonic and nootropic agent in general. Improvements in scopolamine-induced memory deficits in mice have also been associated with *Withania Somnifera* extracts, by inhibiting haloperidol or reserpine-induced catalepsy attributed to potent antioxidants, antiperoxidant and free radical quenching properties, also display an antiparkinsonian effect on neuroleptic-induced catalepsy.

Effect on Immunity⁵³ - *Withania Somnifera* is known to have Immuno-potentiating and myelo-protective effects by increasing interferon (IFN)- γ , interleukin (IL)-2 and granulocyte-macrophage colony-stimulating factor levels in normal and cyclophosphamide-treated mice. As the plant is iron-rich, it adds to the number of red blood cells. The *Withania Somnifera* is more complex than suppressing the immune/inflammatory response in the immune system. The active compound withanolide A in the roots of *Withania Somnifera* greatly increases the T-helper 1 (Th1) cytokine expression levels, as well as the CD4 and CD8 counts. It also increases the dose-dependent function of natural killer (NK) cells with a quicker recovery of CD4+ T cells in immune-suppressed animals.

Immunomodulatory properties⁵⁴- For their immunomodulatory and central nervous system effects, glycowithanolides and a mixture of IX and X sitoindosides isolated from *Withania Somnifera* were evaluated. Both compounds, administered orally (50-200 mg/kg orally), also developed significant anti-stress activity in albino mice and rats. In both young and old rats, they also improved understanding, acquisition,

and memory retention. *Withania Somnifera* root extract was tested in three myelosuppression models in mice for immunomodulatory effects: cyclophosphamide, azathioprine, or prednisolone.¹⁴³ Compared to controls, substantial increases in haemoglobin concentration, red blood cell count, white blood cell count, platelet count and body weight were observed in mice treated with *Withania Somnifera*. There have also been studies of a large increase in hemolytic antibody responses to human erythrocytes (indicating immunostimulatory activity).

The rejuvenating effect of Ashwagandha^{55,56}- *Withania Somnifera* has been reported to have a growth-promoting effect when administered in powdered form alone or in conjunction with other medicines. Withanolides are linked to growth-promoting activity. A significant improvement in haemoglobin, packed cell volume, mean corpuscular volume, serum iron, body weight, handgrip and total proteins were reported in the study conducted in both children and elderly people. In adults, serum cholesterol was reduced, and nail calcium was maintained. The sedimentation rate of erythrocytes decreased dramatically and 71.4% of them showed increased vigour. In short, these studies indicate that *Withania Somnifera* as a general health tonic can prove useful in younger as well as older populations.

In humans, the hypoglycemic and diuretic effects of Ashwagandha roots were also assessed. A blood glucose decrease similar to that of an oral hypoglycemic drug has been observed. There were also significant increases in urinary sodium, urine volume and serum cholesterol, triglycerides, and low-density lipoproteins.

DISCUSSION AND CONCLUSION

The available scientific data support the conclusion that *Ashwagandha* (WS) is a real potent Rasayana (regenerative tonic). The literature revealed that *Ashwagandha* (WS) is a rich source of pharmacologically and medicinally important compounds such as withaferins, sitoindosides, and a variety of beneficial alkaloids. *Ashwagandha* is used as a household remedy by Indians, who consider it as best tonic for old person and

children and as *Vrishya* (aphrodisiac) by young people. It is one the most using nervine tonics of *Ayurveda*. The *Ashwagandha* has also been widely studied for their various pharmacological activities like an Antioxidant, adaptogen, memory enhancing, anti-parkinsonian, antivenom, antiinflammatory, antitumor properties. Various other effects like immunomodulation, hypolipidemic, antibacterial, cardiovascular protection, sexual behaviour has also been studied. *Ashwagandha* (WS) used as a multi-purpose medicinal herb in Ayurvedic medicine for centuries, a more clinical trial should be conducted to support its therapeutic use.

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