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№ 7599

Review on Ashwagandha: a Wonder Plant

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March 19, 2022

Review on Ashwagandha: A Wonder plant

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Abstract. Ashwagandha is a world-renowned herbal medicine that roots back in ancient India and Indian Ayurveda. This herbal plant possesses variety of quality health promoting potentials and therapeutic uses. Studies found that the plant not only helps in the treatment of day-to-day occurring health problems such as cough, constipation, fat loss but also in neurodegenerative disease like Alzheimer which have a destructive effect on Central Nervous System of the human body and various other severe health issues including blood pressure, diabetes, cancer, arthritis from which some of them are discussed briefly below and also different forms in which it can be consumed and enjoyed rather than gulping it as a medicine. This review paper shows the amazing benefits of a majestic natural herb and how it can be used to cure various illnesses.

INTRODUCTION

Ayurveda is one of the oldest practices developed in India thousands of years ago for healing of the whole system of the human body, Ashwagandha is one powerful constituent in this system. Ashwagandha's scientific name is *Withania somnifera* which belongs to the Solanaceae family. The reason why it is named so takes us to its's roots which smell like a horse and thus got named after it [1]. It is also called as Indian white cherry& is a perennial plant grown throughout the Indian sub-tropical regions as a late rainy season crop. The benefits of this plant were firstly mentioned in Rig Veda which was written somewhere between 3500 to 1500 BC. This ayurvedic medicine as a matter of fact was compared to Chinese ginseng which is praised in ancient Chinese scriptures. India is such a diverse country and so is the language hence ashwagandha is known with different names like Akshan in Punjabi, Asgandh in Hindi, Amukkira in Tamil, and Tilli in Marathi [2].

Ashwagandha is said to be a herb which if taken daily can help to delay senescence and helps in the rejuvenation of male and female reproductive fertility, increasing muscle strength [2]. In Ayurveda, Unani and Siddha it is used for the treatment of cold and cough, stress, nervous breakdown, loss of memory [3]. The reason which makes the plant so unique is that it owns the largest and most diversified group of *withanolides* (i.e group of minimum 300 steroids naturally occurring in nature that is built on ergostane skeleton) accompanied by *glycowithanolides* which are the sole bio-active ingredient of this plant. Various studies on this plant have shown that it has anti-depressant, anti-sedative and anti-seizure properties, making it suitable to cure various neuro-related disorders, age-related disorders like arthritis, stress, or problem in behaviour [4]. Inflammation is caused in the human body as a result of any injury, pain, swelling, heat, etc, it is a very natural body responsive process against physical trauma, harmful chemical, or microorganism. The regular medicine used for its management has various serious side-effects like gastric issues resulting in gastric ulcers. *W.somnifera* is a natural herb without any side effects so a study was done to experiment whether it has anti-inflammatory properties also[5]. In accordance to WHO, the traditional Indian, Unani and African medicine are categorised as a food substance which is Generally Regarded As Safe (GRAS) [6]. The result came in favour of proving that the plant has anti-inflammatory properties against in vitro denaturation of protein. There are huge advantages in using herbs as medicines as they do not have any side effects & are pocket friendly, thus can be used even by the weaker section of the society who can't afford the big bills of the hospitals. Not only in the Indian subcontinent it is used, but also in the developed countries like the USA & UK. In these countries, it is also taken as a daily dietary supplement [5].

EXTRACTION AND CHEMICAL COMPOSITION

Immediately after harvesting of roots, they are washed & dried. And later grounded mechanically into a rough-textured powder which is stocked into an air-tight container for further use. For the preparation of the extract, take 50g of the above-stocked powder with 400ml of 50% aqueous solution of ethanol & boil it for 30 minutes under reflux. The next step is to filter the extract and evaporate it to dry to produce the dry extract (HAWS,yield: 37.44%). The resulted extract is then kept in a refrigerator until used again [7].

After performing the chemical analysis of Ashwagandha, the main ingredient is alkaloids and steroidal lactones, although withanine remains the main component. There are also other alkaloids namely, somnine, choline, somniferinine, tropine, pseudo-tropine, 3-a-gloyloxytropine, with alanine cuscohygrine, pseudo-withanine, isopelletierine, anaferine, and anahydrine, somniferine. The C28 steroidal nucleus is the withanolides present within the leaves with a side chain of C9 and a lactose ring of six members. Ashwagandha plant is composed of starch, maltose, sucrose, rhamnose, and carbohydrate D-glucose. It also contains various amino acids, proteins, and the shankpushpine having 162-164℃ its melting point [8]

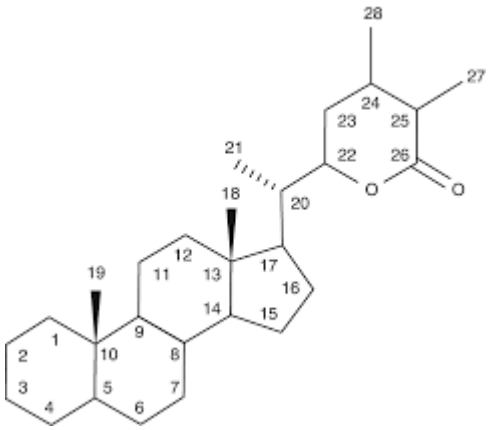

FIGURE 1. Withanolide skeleton[4]

HEALTH BENEFITS OF ASHWAGANDHA

The roots of this plant are bitter, somniferous, diuretic and tonic, whereas the leaves are antibiotic, anti-inflammatory, and anti-tumorous. And the seed of the plant depicts hypnotic, milk-coagulating characteristics [8]. In ethnomedicine, ashwagandha is a renowned herbal tonic and food which helps in serious diseases as cardiovascular. This is available in the form of a single herb or polyherbal or Herbo mineral form. The advised human dosage ranges between 4-6 g/day and is expected to be safe and effective. It also has a great influence on the stress-related issue and it is worth noting that it helps in alleviating stress-induced changes and helps ischemic rat's cardio protection, a property shown similar to adaptogens like *Panax ginseng.* Furthermore, increases heart weight, glycogen in the myocardium and liver which not only indicates the intensified anabolic processes but also helps in enhancement of the period of contractility and coagulation time [4]

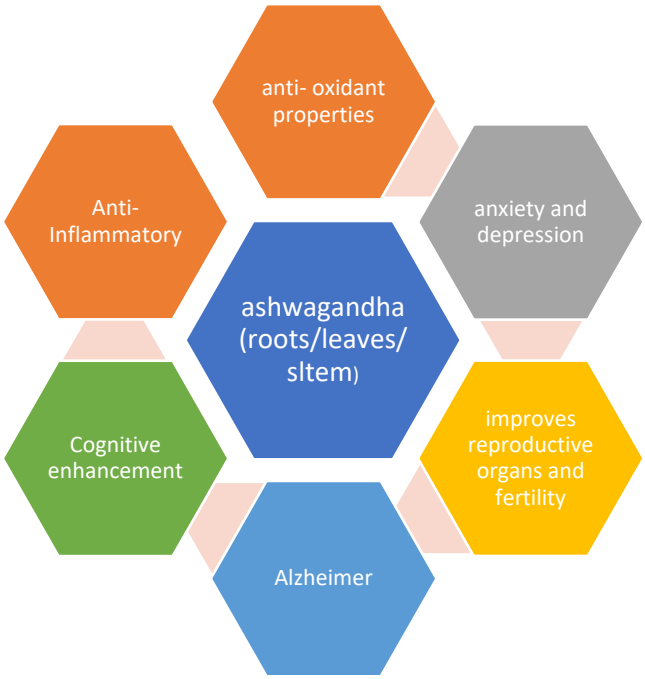

FIGURE 2. Uses of Ashwagandha

Anti-Inflammatory Properties of Ashwagandha

Ashwagandha can cure arthritis symptoms and other inflammatory illnesses and works as a highly effective anti-inflammatory substance compared to other commonly prescribed drugs called hydrocortisone. And also, it can cause a suppression of macroglobulin which is an indication of anti-inflammatory activities in serum of rats [4]. But there are also various problems concerning the animals in scientific researches like ethics, morals when there is an option to use different methods other than them to research on. Therefore another study investigates the anti-inflammatory properties of hydro alcoholic extract of the *W.somnifera* (HAWS) through protein denaturation bioassay. The main cause of arthritis and other inflammatory disease is the denaturation of tissue proteins [7]. Ashwagandha works as a pain reliever that prevents pain signals to travel through Central Nervous System because it has the properties which help in soothing the pain [9].

Cognitive Enhancement

As our age increases, there is a decrease in cognitive ability. Ashwagandha has been associated to improve this condition in a variety of cognitive conditions. When 8-week long research was studied using double-blind designed with placebo-controlled, among other 50 subjects, the therapy of Ashwagandha root aqueous extract was linked with remarkably boosted score compared to placebo in instant memory dataset scores and mainstream memory. Moreover, the results were used to prove that the plant was also efficacious in developing the management of functions, attention, and measure of cognitive enhancement efficiency [10]. In a similar clinical trial, twenty healthy male members were given two capsules of dried aqueous extract from leaves or roots of *Withania somnifera* in 250 mg capsule twice daily for a course of a fortnight. The psychomotor and cognitive efficiency was examined before the dose on the first day and fifteenth day three hours post medications using psychometric tests. And the results showed remarkable improvements in aspects of a simple reaction, card scoring test, discriminatory choices, digital character interchangeability contrasted to placebo. All these developments indicated that this ayurvedic plant extract can boost up cognitive and psychometric conduct [11].

Alzheimer

This disease falls into the category of neurodegenerative which mainly follows memory loss and reduced cognitive functions [12]. This disease is more common in elder people , Americans (nearly 5 million) have Alzheimer's and this would reach upto the mark of 7.7 million by 2030. Generally, symptoms arise near the age of 30 years and certain early-onset of this can also be associated with genetic effects. Early symptoms include

Amnesia, mood swings, forgetting names, losing things, etc. The cause of this disease is still unknown but genetic factors are related to many cases [13]. Beneath all symptoms, reduced number of neurons in cortex and hippocampus occur [14].

Ashwagandha's roots exhibits a soothing effect in the Central nervous system in numerous mammals. A double-blind design with a placebo-controlled study took place which showed that the plant helped in reducing stress and decreasing other symptoms like mind wandering and also the dosage of 500 mg/day was advised for better results [15]. It was also reported in another study that this plant helps in better learning and increased memory [16].

TABLE 1. Functions of Ashwagandha Constituents, Derivatives and Extracts on Neurodegenerative Diseases

Disease models	**Materials**	**Functions**
Alzheimer's disease/Dementia	Extract	Neurite outgrowth *in vitro* Improvement in memory, Neuroprotective effects in vitro Aβ clearance *in vivo*
	Withanolide A	Axonal regeneration, Neurite outgrowth *in vitro* , synaptic reconstruction *in vitro* and *in vivo* Improved memory, Upregulation of BACE1, ADAM10, IDE *in vitro*
	Denosomin	*in vitro* Neuroprotective effect, Axonal regeneration
	Withanone	Neuroprotective effects *in vitro*
Spinal cord injury	Withanoside IV	Axonal growth *in vivo*
	Denosomin	Axonal growth *in vivo*
Parkinson's disease	Extract	Anti-oxidant effect *in vivo,* Functional recovery
Huntington's disease	Extract	Anti-oxidant effect *in vivo*

[17]

Reproductive Health

Globally, Infertility is now affecting 48.5 million couples where 50% of the cases are of male infertility [18]. Such kind of inability can cause stress and also disturb mental health [19] and affect couples' married life and their individual lives [20]. *W. somnifera* has several benefits and one of them is to help enhance male fertility and inhibits lipid peroxidation (LPO) [21] in spermatozoa which hold a key role in male infertility. Furthermore, it also balances testosterone in those males who are suffering from physical or psychological stress [22]. When a clinical trial was done on a group of men and the results were worth noticing as the sperm concentration was increasing and so was the mobility. The dose comprised of 5g/day oral ingestion of ashwagandha root extract with milk for 3 months [23].

TABLE 2. Effect of *Withania somnifera* on different parameters of Semen

Ashwagandha (root extract)	Subject	Fertility status of model used	Treatments	Result
Spermatogenic ability	Man	Oligozoospermic sperm count	675 mg thrice a day for 90 days where n is 46	Rise in sperm count
Semen quality	Man	Normozoospermic with either idiopathic infertility (psychological stress/cigarette smoking history)	5 g/day for 3 months with milk where n is 20	Rise in sperm concentration and motility
Semen	Man	Infertile with normozoospermia	5 g/day orally for 3 months with milk where n is 25	Increase in Semen volume, motility and sperm count per ejaculation
Sperm count	Rats	Arsenic (8 mg/kg for 45 days) induced testicular impairment	100 mg/kg/day orally for 30 days where n is 24	Improvement in Sperm count and motility
Semen quality	Rats	Alcohol-induced testicular impairment	200 mg/kg for 28 days (Orally)	Rise in sperm count and motility , reduced sperm morphological abnormality.
Semen quality (Methanol-water)	Sprague– Dawley rats	Normal Rats	300 mg/kg for 8 weeks where n is 7 (Orally)	Increased sperm count
Fertility of male	Holtzman rats	Rats (adult male)	90 or 180 mg/kg of Afrodet plus containing 100 mg extract for 21 days	Increased sperm count

Anxiety and depression

Ashwagandha in Ayurveda is used as a mood stabilizer [25], powdered extract from leaf has anti-anxiety properties [26], Extract from roots have also been noted to have the same effect as well. When an alcoholic extract of the root of dosage 100 mg/kg intraperitoneal for a single dose to mice, an extraordinary performance was observed in swimming by the mice who received the dosage. It was also noticed that the mice who received the dose had increased its pace to double which made it clear that extracts of WS created resistance for stress conditions [27]. The magical plant helps in lowering down the cortisol levels which are produced by adrenal glands which in turn is a feedback mechanism to stress and concluded that anxiety levels of 88% of people were reduced after consuming Ashwagandha.

Depression is said to be a disorder where the health of the brain is affected which in return is associated with mood swings, disappointments, misbehaviour, sadness, thoughts, and feeling of lost self-worth. Also, sleep patterns and day-to-day chores are disturbed. Roots of *Withania somnifera* have glycowithanolides in roots and at the dose of 20 and 500mg/kg has the potential of an antidepressant effect and hence supporting the role of mood stabilizer [28].

Anti-oxidant properties

Numerous researches have shown that this ayurvedic plant has anti-oxidant effects also [29]. The presence of phytochemical compounds in various parts in *W.somnifera* is the reason behind its medical importance which makes it suitable for scientific researches [30]. It was also found in one of the research projects that ashwagandha can be a good source of enzymes and non-enzyme antioxidant constituents [31]. The antioxidant activity also is the reason which helps this plant to become a neuroprotector, these activities are generally seen when the levels are seen to decrease or normalized level of reversed LPO levels [28].

Ashwagandha and food products

The plant has usage on a large scale as it is used as a health supplement which helps in balancing the tridosha (Pitta,Vata, and Kapha). Extracts of leaves and roots in powdered form are used to make ashwagandha chutney, shrikhand, roti, namakpara, etc. to receive the above-mentioned health benefits [32]. Fortified snacks were developed and it was discovered that these products were more beneficial. Extrusion cooking, when combined with ancient method of cooking, resulted in the production of increased herbal antioxidant properties [33]. Sweet deserts were combined with cereal-legume and root powder of Ashwagandha which turned out to have very high nutritional qualities as well as a good composition of mineral content, crude fibre, and enhanced organoleptic characteristics. The bitter taste of the roots was overpowered by the sweetness of jaggery, the shelf life was around 30 days, and advised to consume within 15 days[33].Discussions also included Cheela and Cookies where it was found out that the nutritional qualities when incorporated with medicinal powder had increased protein content, energy, carbohydrate, calcium, vitamin C, and other antioxidant properties [34] .Another study reported that 0.5 % powder of *Withania somnifera* in shrikhand boosted the power of sensory organs. The product proved to be self-stable and can be consumed for 52 days in refrigerator conditions [35].

CONCLUSION

Ashwagandha is used as a popular home medication, thus had also proven to be the best tonic for people of all ages for thousands of years. All the above-stated benefits denote that the traditional use of this plant was both scientifically and logically correct. Among various physiological parts, roots are most valuable in the treatment of diseases like cough, insomnia, memory lessness, anxiety, muscular strength, and sterility and influence the nervous system, endocrine system, and cardiac system. The Ashwagandha fortified foods fulfil our daily nutrient needs and treatment of various diseases as well, and due to its bitter taste, this plant cannot be consumed raw. An endless number of studies have been done to study the benefits of *Withania somnifera* and the change it creates in today's hectic human life. Undoubtedly, the effects of this herb are up-and-coming as a multi-purpose medicine but there is also a need to explore more, and more clinical trials need to be done for better and safe usage.

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