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An Overall Review on Withania Sominfera and Its Applications

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Abstract

Withania somnifera (Ashwagandha) is one among the wide diversity of the medicinal plant, which is exploited well for its phyto-pharmacological effect. The medicinal properties of Withania somnifera is available both in the written and non-written format as traditional knowledge since time immemorial. In traditional system, the plant has been used as an anti-inflammatory, antitumor, antistress, antioxidant, immunomodulatory and adaptogenic drug. It also exerts a positive influence on the endocrine, cardio-pulmonary, and central nervous systems with little or no associated toxicity. The results are very inspirering and show this herb should be studied more extensively to confirm these results and reveal other potential therapeutic effects. In this article the importance of this herb along with its extraction procedures, Identification methods and applications were discussed

Key Words: Ashwagandha root; venom toxins; Withaferin A; withanolides; withaferins

Introduction:

Withania somnifera (WS) has been an important herb in the Ayurvedic and indigenous medical systems for over 3000 years. *Withania somnifera* , is a commonly used herb in Indian Ayurvedic medicine system. Due to its pharmacological value and an inexhaustible source of novel biologically active compounds, it has been a great interest for researchers. Ashwagandha in Sanskrit means "horse's smell" very likely begin from the odour of its root, which resembles that of sweaty horse. The species name *somnifera* means "sleep-making" in Latin, attributed to sedating properties, but it has been used for sexual vitality and as adaptogenic properties also. As a rasayana herb, the decoction and extracts of the herb shows excellent immunomodulatory activity by activation of macrophages, granulocytes, complement systems, natural killer cells and lymphocytes. The plant is known to have anti-inflammatory, antitumor, antistress, antioxidant, immunomodulatory and hemopoetic properties. Various withanolides, steroidal lactones, has been isolated from *W. somnifera* . It is used for a very long time for all age groups and both sexes and even during pregnancy without any side effects.(3) In ancient, the plant has been used as an antioxidant, adaptogen, aphrodisiac, liver tonic, antiinflammatory agent, astringent and more recently to treat ulcers, bacterial infection, venom toxins and senile dementia. Clinical trials and animal research support the use of WS for anxiety, cognitive and neurological disorders, inflammation, hyperlipidemia and Parkinson's diseases. Recently WS is also used to inhibit the development of tolerance and dependence on chronic use of various psychotropic drugs. *Withania* species show a particularly wide distribution throughout drier climates of the world[1] .

Uses of withania somnifera(root) [2]:

The root of Ashwagandha is considered as tonic, aphrodisiac, narcotic, diuretic, anthelmintic, astringent, thermogenic and stimulant. It is commonly used in emaciation of children debility from old age, rheumatism, constipation, insomnia, nervous breakdown, goiter etc. The paste formed when roots are crushed with water is applied to reduce the inflammation at the joints. It is also locally applied in sore, ulcers and painful swellings. The root in combination with other drugs is advised for snake venom as well as in scorpion-sting. It also helps in leucorrhoea, boils, pimples, flatulent colic, worms and piles. The Nagori Ashwagandha is the supreme among all Ashwagandha varieties. Maximum benefit seems when fresh Ashwagandha powder is used.

Uses of withania somnifera (leaves):

The leaves are pungent and are suggested in fever, painful swellings. The flowers are astringent, depurative, diuretic and aphrodisiac. The seeds are anthelmintic and synthesized with astringent and rock salt remove white spots from the cornea. Ashwagandharishta it is used in hysteria, anxiety, memory loss, syncope, etc. It also acts as a tonic and increases the sperm count. **Parts used:** Whole plant, roots, leaves, stem, green berries, fruits, seeds, bark are used.

Steroidal compound [3]:

Withanolides glycol with anolides and alkaloids. These contain withaferin A, Withanolides G&D sitoindosides IX&X and with asomnine. These have been discribed as active marker for standardization. Withaferin A, - a steroidal lactone is the most major withanolide saperated from the extract of the leaves and dried roots of Withania somnifera. Anti-inflammatory activity has been allocated to biologically active steroids, of which withaferin A is a major component. The activity is comparable to that of hydrocortisone sodium succinate. Withaferin A also showed remarkably protective against CCl4 induced hepatotoxicity in rats. It was as effective as hydrocortisone dose. The healing properties of the leaves and roots are attributed to Withaferin A. Withaferin A is antitumour, antiarthritic and antibacterial.

Phytochemical Constituents [4,5]:

The biologically active chemical constituents of Withania somnifera (WS) include alkaloids (anaferine, anahygrine, etc.), steroidal lactones (withanolides, withaferins) and saponins.
Sitoindosides in Ashwagandha are anti-stress agents. Active principles of Ashwagandha, for example the sitoindosides and Withaferin-A, have been shown to have significant anti-stress activity against acute models of experimental stress. Many of its constituents support immunomodulatory actions. The aerial parts of Withania somnifera yielded 5-dehydroxy withanolide-R and withasomniferin-A .The biologically active chemical constituents are alkaloids (ashwagandhine, cuscohygrine, anahygrine, tropine etc), steroidal compounds, including ergostane type steroidallactones, withaferin A, withasomniferin-A, withasomidienone, withasomniferols A-C, withanone etc. Other component includes saponins containing an additional acyl group (sitoindoside VII and VIII), and withanolides with a glucose at carbon 27. Apart from these pacify plant also contain chemical constituents like withaniol, acylsteryl glucosides, starch, reducing sugar, hantreacotane, ducitol, a variety of amino acids including aspartic acid, proline, tyrosine, alanine, glycine, glutamic acid, cystine, tryptophan, and high amount of iron. The biologically active chemical constituents of Withania somnifera (WS) include alkaloids (isopelletierine, anaferine, cuseohygrine, anahygrine, etc.), steroidal lactones (withanolides, withaferins) and saponins.

Preparation of extract (root) [6,7]:

The root of withania somnifera obtained were separately dried and milled.About 100g coarse powder was extracted successively using soxhlet extractor with solvent of increasing polarity such as n-hexane,ethyl acetate and ethanol in solid/solvent ratio 0.33,respectively for 10 h each. The exract was then concentrated in a rotatory evaporator.

Preparation of plant extracts: LEAVES:

W. somnifera leaves were brought from village. Plant leaves were cleaned, air-dried then crushed to a fine powder on receipt. A 24 h soxhlet extraction was used to prepare three separate crude extracts from the leaf powder using water, ethanol, and ethanol/water (50:50) as the solvents. After the soxhlet extraction, the ethanol was evaporated using a rotary evaporator, and the water was removed by using a freeze dryer. The dry end-products were stored in glass containers, protected from light at −20°C.

Photochemical screening of extracts [8,9]:

Preliminary phytochemical screening was carried out on the different extract for detecting the presence phenols,flavanoids,tannins,steriods,terpenoids,phytosterols ans saponins using alcoholic ferric chloride, shinoda test,breamers reagent,leiberman-burcherd reagent and foam test respectively,presence of alkaloids was analysed by dragondorff's wagner's and hager's reagent(9).

1. Test for carbohydrates:

There are some tests performed for carbohydrates.
1.1. Molisch's test: Sample of plant extract was taken in a test tube. Then 20% alcoholic solution and concentrated sulphuric acid, which is freshly prepared is added in to test tube along the sides. This test develops reddish violet and purple colour at junction between two liquids if carbohydrates present in the sample extracts.

1.2. Benedict's test: Take a test tube, which contain small amount of plant extracts sample. In a test tube added small quantity of benedict's solution**ssssss**and mix properly. Thenboile this sample mixture for two minutes and cool it. If carbohydrates present in the sample, it forms red precipitate.

1.3. Barfoed's test: The barfoed's solution added to 0.5 ml of solution under examination, heated to boil. If carbohydrates present in the sample extracts, it forms red precipitate of copper oxide.

2. Test for alkaloids:

2.1. Dragendorff's test: Take a few mg of extracts sample and dissolve in 5ml water. Then 2 M hydrochloric acid added until an acid reaction developed. In this mixture, 1ml of dragendorff's reagent (potassium bismuth iodine solutions) was added. If alkaloids present in sample extracts, it forms orange red precipitate.

2.2. Wagner's test: Acidify the plant extract sample with hydrochloric acid (1.5% v/v) and add a few drops of Wagner's reagent (iodine potassium iodide solution) in the test tube. It forms reddish brown precipitates which indicate the presence of alkaloids.

2.3. Mayer's test: 2ml of plant extracts sample was taken and 2 - 3 drops of Mayer's reagent was added (potassium mercuric iodine solution) in the test tube. If alkaloids present in the sample, it forms dull white precipitate.

3. Test for glycosides:

3.1. Legal's test: Take an extracts sample and dissolved in pyridine then add sodium nitroprusside solution. Make this solution completely alkaline. Presence of glycosides produce pink red colour.

3.2. Baljet's test: Take a plant extracts sample in the test tube and add sodium picrate solution. Presence of glycosides produce yellow to orange colour.

3.3. Borntrager's test: The test solution of plant extract was added in few ml of dilute sulphuric acid solution. This solution was filtered. Then Chloroform and ether was added in to filtrate and shaken well. In this solution ammonia was added and separated the organic layer. Organic layer shows pink, red or violet colour due to the presence of glycosides.

4. Test of saponins:

a)1ml of alcoholic sample extract was taken and diluted with 20ml of distilled water. This solution was shaked for 15 min in graduated cylinder. If saponins present in the extracts, it generates foam layer of 1cm.

5. Test for flavonoids:

5.1. Shinoda test: Taken the alcoholic sample extract in the test tube and 5-10 drops of hydrochloric acid added in the sample. Then small pieces of magnesium added in tubes. Reddish pink or brown colour was indicated the presence of flavonoids.

5.2. Alkaline reagent test: Plant extracts sample was mixed with 2ml of 2% NaOH solution. It produced yellow colour. In this solution, 2 drops of diluted acids was added. If flavonoids present in the extracts, yellow colour changed into colourless.

6. Test for tannins:

a) Take the sample of plant extracts in the test tube and added ferric chloride solution. If tannin present in the sample, dark blue or greenish black colour appeared.
b) Take the sample extracts and add potassium cyanide. It produces deep red colour, which indicate the presence of tannins.
c) Potassium dichromate was added into sample extracts. Yellow precipitate was formed indicate the presence of tannins.

7. Test for protein and amino acid

7.1. Biuret's test: Take 2-3 ml of sample extract and add 1 ml sodium hydroxide solutions (40%) and 2 drops of copper sulphate solution (1%) and mix properly. Presence of proteins shows a pinkish - violet and purple - violet colour.

7.2. Ninhydrin's test: Plant extracts sample mixed with freshly prepared 2 drops of 0.2% ninhydrin solution and heated to boiling for 1-2 min and allowed cooling. Blue colour appearance indicates the presence of amino acids, proteins, peptides.

7.3. Xanthoprotein test: Extracts sample was taken in test tube and added conc. nitric acid. A white precipitate was obtained and upon heating turns to yellow and cool the solution carefully. 20% sodium hydroxide solution added in excess, which produce orange colour that indicate the presence of amino acids.

8. Test of fats or fixed oils:

8.1. Using sodium hydroxide: The extract was mixed in one ml 1 % of copper sulphate solution then 10% sodium hydroxide solution was added. Blue colour appears in the solution, which shows the presence of glycerin.

8.2. Saponification: plant extracts was taken and mixed with 2% sodium carbonate solution. Shaked vigorously and boiled. A clean soapy solution was formed cooled and few drops of conc. HCl was added and observed that fatty separate out and float up.

Applications of withania somnifera [10, 11]:

1. **Reducing side effects associated with medications called antipsychotics:** Antipsychotics are used to treat schizophrenia, but they can cause levels of fat and sugar in the blood to increase. Taking a specific ashwagandha extract. 400 mg three times daily for one month might reduce levels of fat and sugar in the blood in people using these medications.

2. **Anxiety:** Some clinical research shows that taking ashwagandha can reduce some symptoms of anxiety or anxious mood.

3. **Bipolar disorder:** Taking a specific ashwagandha extract (Sensoril, Natreon, Inc.) for 8 weeks might improve brain function in people being treated for bipolar disorder.

4. **A brain condition called cerebellar ataxia:** Preliminary research shows that ashwagandha in combination with an alternative form of medicine known as Ayurvedic therapy might improve balance in people with cerebellar ataxia.

5. **Fatigue in people treated for cancer (chemotherapy):** Early research suggests taking a specific ashwagandha extract 2,000 mg (Himalaya Drug Co, New Delhi, India) during chemotherapy treatment might reduce feelings of tiredness.

6. **Diabetes:** There is some evidence that ashwagandha might reduce blood sugar levels in people with diabetes.

7. **High cholesterol:** There is some evidence that ashwagandha might reduce cholesterol levels in patients with high cholesterol.

8. **Underactive thyroid (hypothyroidism):** People with underactive thyroid have high blood levels of a hormone called thyroid stimulating hormone (TSH).

9. **Male infertility:** Some preliminary clinical evidence suggests that ashwagandha might improve sperm quality, but not sperm count, in infertile men. It is not known if taking ashwagandha can actually improve fertility.

10. **Osteoarthritis:** Early research shows that ashwagandha taken along with a zinc complex, guggul, and turmeric might improve arthritis symptoms. The impact of ashwagandha alone is unclear.

11. **Parkinson's disease:** Preliminary research suggests that a combination of herbs including ashwagandha improves Parkinson's symptoms. The effect of ashwagandha alone in Parkinson's is unknown.

Conclusion:

Mayer's reagent etc and chemical such as sodium nitroprusside solution, nitric acid, ferric chloride shows presences of flavonoids,saponins,tannins alkaloids proteins and amino acids . In traditional system, the plant has been used as an anti-inflammatory, antitumor, anti-stress, antioxidant, immunomodulatory and adaptogenic drug. It also exerts a positive influence on the endocrine, cardio-pulmonary, and central nervous systems with little or no associated toxicity. Furthur clinical trials has to performed to confirm its safety and pharmacological property.

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