***Review Article***

# An overview on health benefits of *Withania somnifera* (ashwagandha) in veterinary medicine


## ABSTRACT

Ayurvedic plants are now used more frequently in veterinary medications because they are organic and have lower toxicity and negative side effects. Ashwagandha, also known as *Withania somnifera*, is a well-known herbal plant cultivated in arid regions of India that is used in traditional medicine. Different plant components have medicinal capabilities, but the root offers the greatest number of advantages for health. Alkaloids, flavonoids, polyphenol, steroidal lactones (withanolides, withaferins), saponins containing an additional acyl group (sitoindoside VII and VIII), and withanolides (sitoindoside IX and X) are the main active phytoconstituents in plant extract acquires immunomodulatory, hemopoietic, hepatic tonic, anti-inflammatory, adaptogenic, antitumor, antistress, antibacterial, antioxidative, and astringent properties. The most popular and widely utilized root powder of *W. somnifera* for pharmacological research is its aqueous, ethanolic, methanolic, and ether extracts.



*Keywords: ashwagandha, phytoconstituents, extract, medicine*


## 1. INTRODUCTION

In India, ethnoveterinary practices were in vogue since time- immemorial. Ethnoveterinary medicine is a concept dealing with the folk beliefs, knowledge, skills, methods, and practices about the healthcare of animals that have been defined. Atharvaveda is a repository of traditional medicine including prescriptions for treatment of animal diseases. Among the best-known works are Asvachikitsita (therapeutics of horses) and Asvavaidyaka (medicine of horses), which probably originated in the 13th century. India has a strong historical tradition in the area of ethnoveterinary medicine and practices, but as the country modernizes, this expertise is disappearing quickly. Ethno-veterinary practices are often cheap, safe, long time-tested, based on local resources and strengths. It proved a useful alternative to modern animal health care systems. India is sitting on a gold mine of well-recorded and well-practiced knowledge of traditional herbal medicine and is regarded as one of the 12 mega biodiversity centers having over 45,000 plant species. Medicinal plants are still the mainstay of about 70–80 % of the world population, largely in developing countries, for primary healthcare needs because of better cultural acceptability, better compatibility with the human body, and lesser side effects. They are subjected to a single solvent extraction once or repeatedly, or water decoction or as described in ancient texts. (Kamboj, 2000).

*Withania somnifera* (Ashwagandha, Family- Solanaceae) popularly known as Indian ginseng/ winter cherry, is an important herb in Ayurveda and the indigenous medicinal system for over 3000 years to treat various disorders. In Sanskrit, ashwagandha, the Indian name for *Withania somnifera*, means "odor of the horse", probably originating from the odor of its root which resembles that of a sweaty horse. It is in use for a very long time for all age groups, both sexes, and even during pregnancy without any side effects (Sharma *et al*., 1985). *Withania somnifera* (Ashwagandha) possesses anti-inflammatory, adaptogenic, antitumor, antistress, antibacterial, liver tonic, antioxidative, immunomodulatory, hemopoietic, and astringent properties (Mishra *et al*., 2000).

## 2. MORPHOLOGY AND DISTRIBUTION

*Withania somnifera* wildly grows in all drier parts of subtropical India and occurs in Madhya Pradesh, Uttar Pradesh, Punjab plains, and northwestern parts of India like Gujarat and Rajasthan. Roots are 20-30 cm long and 6-12 mm in diameter, with few (2-3) lateral roots of slightly smaller size, straight, and unbranched (John, 2014). Ashwagandha plant grows to erect up to 60 cm in height in the spring season and its roots are fleshy, brown in color, and mainly used for all therapeutical uses (Gupta and Rana, 2007). This shrubby plant is distributed in various parts of the world mainly in East Asian and African countries. In East Asian countries this energizing herb is cultivated in India, Bangladesh, Sri Lanka, Nepal, and Pakistan. (Rayees and Malik, 2017). In India, it is widely distributed in the provinces of

Madhya Pradesh, Uttar Pradesh, Punjab Gujarat, and Rajasthan (Kumar et al., 2015). Ashwagandha is a woody shrub that grows efficiently in dry and arid soil of acidic nature (Srivastava *et al*., 2018).

## 3. PHYTOCONSTITUENTS

The root powder of *Withania somnifera* was screened for evaluation of phytochemical constituents and confirmed with the presence of carbohydrates, starch, tannin, saponin, glycoside, phenol, and alkaloid. Amino acids, flavonoids, and saponins were the active constituents present in aqueous extract while ethanolic extracts indicated the presence of saponin, alkaloids, phenolics, glycosides, starch, terpenoids and flavonoids (Arya and Chouhan, 2019). *Withania somnifera* signifies the presence of saponins, cardenolide, glycosides, polyphenol compounds, flavonoids, tannins, and reducing substances in its aqueous extract. Proteins and alkaloids were found absent in the extract (Attanayake *et al*., 2016)
Ashwagandha possesses anti-inflammatory, antitumor, antistress, antioxidant, immunomodulatory, hemopoietic, and rejuvenating properties. The biologically active chemical constituents are alkaloids (isopelletierine, anaferine), steroidal lactones (withanolides, withaferins), saponins containing an additional acyl group (sitoindoside VII and VIII), and withanolides with a glucose at carbon 27 (sitoindoside IX and X) (Mishra *et al*., 2000). Phytoconstituents in the various extract of *Withania somnifera* prepared by the Soxhlet method. Yield (%), Total phenolics (mg/g GAE), Withanolide A (lg/mg), and Total withanolides (lg/mg) content in aqueous extract were estimated as 9.51 17.63 1.14 and 1.50, respectively. Thus, the antioxidant activity of the aqueous extract of *Withania somnifera* prepared by the Soxhlet method was found more than ethanolic extract (Dhanani *et al*., 2013). Polyphenols contain an aromatic ring with –OH or OCH3 substituents which together contribute to their biological activity, including antioxidant action. Polyphenols can chelate transition metal ions, can directly scavenge molecular species of active oxygen, and can inhibit lipid peroxidation by trapping the lipid alkoxyl radical (Arora *et al*., 2000). The pharmacokinetics and safety of the sustained-release capsules root extract of *W. somnifera* reveals higher plasma concentrations of total withanolides, withanolide A, and 12 deoxywithastramonolide demonstrates its higher pharmacological activity (Alluri *et al.,* 2021).

## 4. PHARMACOLOGICAL EFFECTS

The various extract of root powder of *W. somnifera* exerts most of the pharmacological activities due to the presence of various beneficiary phytoconstituents and different health benefits are described below.

### 4.1 Immunomodulatory and Hemopoietic activity

W. somniferous extract given to broiler chicks improved their feed intake, body weight gain, hematological profile and immunological status. The significant increase in the value of Hb, PCV, and TLC whereas, a non-significant difference in count of neutrophils, lymphocytes, eosinophils, and monocytes was observed in all treatment groups as compared to control. The study reveals that *W. somnifera* has stimulatory effects on bone marrow and it has to boost effect on the hematopoietic system (Mushtaq *et al*., 2012). An increase in hemoglobin after the administration of *Withania somnifera* in athletes evidenced its ergogenic effect (Malik *et al.,* 2013). The hemoprotective effect of *W. somnifera* might have been due to its positive influence on hemopoiesis (Mishra *et al.,* 2000) or due to its antioxidant activity protecting RBC from oxidative stress and improving erythrocytic enzyme activity (Sujatha *et al.*, 2010). Total serum immunoglobulins were found significantly elevated in calves fed with *Withania somnifera* at the dose rate of 10 gm bid orally for 7 days. Also, a significant increase in the total leukocyte, percent lymphocyte while a decrease in neutrophils, monocytes, and eosinophils was observed in diarrhea buffalo calves supplanted with *Withania somnifera* orally for 7 days (Tripathi and Rajoria, 2012). Withanolides have been studied for immunomodulatory effects and sitoindoside IX and X caused increased platelets count, WBC count, and increased activity of peritoneal macrophages and lysosomal enzymes (Schmelzer and Gurib-Fakim, 2008). Ashwagandha enhances the nitric oxide synthetase activity of the macrophages, which in turn increases the microbial killing power of these immune cells thereby, enhancing the cell-mediated immunity. Scavengers and regulators of lipid peroxidation have been found for flavonoids and other phenolic compounds of plant origin (Iuvone *et al.*, 2003).

### 4.2 Hepatoprotective activity

The root powder of *W. somnifera* offers hepatoprotection by influencing the levels of lipid peroxidation products and liver markers in experimental hyperammonemia. The study revealed that rats treated with *W. somnifera* @500 mg/kg thrice in a week for 8 consecutive weeks, showed significantly low levels of circulatory ammonia, urea, TBARS, AST, ALT, and ALP when compared with the corresponding group in which hyperammonemia condition was developed by administration of ammonium chloride. Hepatoprotective nature of the herb is due to the presence of alkaloids, phenolic compounds withanolides, and flavonoids, its ability to normalize the levels of urea and urea-related compounds, and its antioxidant property (Harikrishnan *et al*., 2008). Withanolides derived from ashwagandha were reported for having hepatoprotective activity. Increased levels of serum enzymes like ALT and AST, which are seen in mice treated with paracetamol, cause structural damage to the liver, resulting in liver damage. *Withania somnifera* root extract has been found to be effective in decreasing the elevated levels of blood liver marker enzymes (Nile *et al*., 2019).

### 4.3 Antioxidant activity

**H**erbal/traditional plant medicine is the most antioxidant-rich category of the various antioxidants. Elevated concentration of antioxidants in several dried herbs compared to fresh samples was observed, as a normal consequence of the drying process leaving most of the antioxidants intact in the dried end product (Paur *et al*., 2011). Antioxidant activity of root extract was higher than those of stem and leaf extract. Antioxidant activity (g AEAA 100g-1 dry extract) of aqueous root extract was maximum (62.2±2.22) followed by ethanol and methanol extract (54.0±1.92 and 54.6±1.81). Antioxidant activity of root extract was higher than those of stem and leaf extract (Sinha, 2012). *Withania somnifera* has been known for its potent antioxidant and free radical quenching properties in various conditions. Scavengers and regulators of lipid peroxidation have been found for flavonoids and other phenolic compounds of plant origin. (Sundarajan *et al.,* 2006). As an antioxidant, *Withania somnifera* and its active constituents (sitoindoside vii-x and withaferin A) have been proven to increase enzymatic antioxidants i.e. catalase and superoxide dismutase (Bhattacharya *et al*., 2001). The active principles such as Sitoindosides VII-X and Withaferin A present in the aqueous extract of *Withania somnifera* provide antioxidative activity. Statistically significant increase in SOD, CAT, and GPX activity in the frontal cortex and striatum was observed after administration of active glycowithanolides of *Withania somnifera* (WSG) (10 and 20 mg/kg, i.p.), once daily for 21 days. A significant increase in CAT and SOD activity was observed both on 14 days and 21 days after administration (Bhattacharya *et al*., 1997). An administration of *W. somnifera* root extract in doses of 0.7 gm/kg and 1.4g/kg body wt. per day along with equivalent doses of lead acetate for 20 days significantly decreased renal and hepatic lipid peroxidation (LPO) and increased the activities of antioxidant enzymes like superoxide dismutase (SOD) and catalase (CAT) (Chaurasia *et* al., 2000). The oral administration of *W. somnifera* root powder (1000 mg/kg b.wt.) modulated both enzymatic and non-enzymatic antioxidant levels to near-normal control levels in the liver of arthritic rats considerably. The enzymic antioxidants- superoxide dismutase and catalase were significantly increased in arthritic rats when compared to control rats, whereas the non-enzymic antioxidants-reduced glutathione, vitamin C, and E were significantly decreased in arthritic conditions. No significant change was observed in the activity of superoxide dismutase, catalase, glutathione, and vit C was observed in the control group administered with *Withania somnifera* as compared to a control group without administration. Administration of *Withania somnifera* root powder modulated the enzymic and non-enzymic antioxidant levels to near normal control levels in arthritic rats considerably. A significant decrease in the level of lipid peroxides was also observed, which indicates its antiperoxidative action. The antiperoxidative effect observed in *Withania somnifera* treated arthritic animals could be mediated through phytosterols, polyphenols, flavonoids, and Vitamin C in *Withania somnifera* root powder (Rasool and Varalaxmi, 2008). The antioxidant property of roots of *Withania somnifera* in mice exposed to lead nitrate induced oxidative effects. Animals exposed to lead nitrate showed a significant decrease in renal SOD, CAT, and GSH activity. On treatment with *Withania somnifera* root extract to the groups which were not exposed to lead nitrate @200mg/kg and @500mg/kg b.wt. revealed an insignificant effect on antioxidant enzymes (SOD and CAT) as compared to untreated group animals (Sharma et al., 2011) Association of uremia and oxidative stress was evaluated by applying the herbal plant *Withania somnifera* (Ashwagandha). Administration of an aqueous extract of *Withania somnifera* revealed antioxidative properties by significantly reducing the plasma CAT and SOD activity in dehydration-induced oxidative stress in male Wister rats. The uremic profile (creatinine and urea) showed considerably good results following treatment with the medicinal plant *W. somnifera* and liver enzymes in blood did not alter after treatment

implying the absence of any toxicity of the root extract (Das et al., 2010). *Withania somnifera* (L.) Poshita regenerated under *in vitro* and *in vivo* regenerated plant parts have effective antioxidant and free radical scavenging activity. Among various parts of the plant, *invitro* and *invivo* regenerated roots of *Withania somnifera* possess high SOD and CAT activity while ascorbic acid activity was reported more in the leaves extract. It can be used in pharmacological and food industries due to its antioxidant properties (Viji and Parvatham, 2014). Horses are more prone to develop anxiety and stress, it is often linked to herd issues, housing conditions, environmental factors, handling methods, training, transportation, and competition. Horses under stress conditions received 30 day's supply of a pure and concentrated ashwagandha extract (4:1) and noted that 10 out of 12 horses, 84% of candidates responded very favorably to the Ashwagandha concentrated extract, generally within 7-10 days beginning of the administration. Ashwagandha is referred to as a potent “Adaptogen” in Ayurvedic medicine and effectively reduced serum cortisol levels (Schell, 2015).

### 4.4 Neuroprotective effect

The efficacy of *Withania somnifera* extract was studied on canine cognitive dysfunction (CCD), a neurodegenerative disease in which there is a decline in learning and memory loss. The pathophysiology behind this neurodegenerative condition was oxidative stress, loss of cholinergic neurotransmission, and deposition of amyloid β peptide and acrolein-induced neurotoxicity. Treatment of human neuroblastoma cell line SK-N-SH with a standardized extract of *W. somnifera* protected against Aβ peptide- and acrolein-induced toxicity, decreased Reactive oxygen species levels, and inhibit acetylcholinesterase (AChE) activity, thus proved its cholinergic and antioxidant modulator activity. The extract of *Withania somnifera* was found beneficial for canine cognitive dysfunction and Alzheimer's disease therapy (Singh and Ramaswamy, 2017). The anticonvulsant effect of *W. somnifera* extract was studied in mice in which a minimal dose of pentylenetetrazol was used to induce different phases of convulsions. Administration of root extract of *W. somnifera* (100 or 200 mg/kg, PO) increased the seizure threshold for the onset of tonic extension. Thus, the use of *W. somnifera* root extract preparation was found beneficial in reducing seizure development during convulsive episodes (Kulkarni *et al.,* 2008). The effect of *W. somnifera* on oxidative stress markers (superoxide dismutase, catalase, glutathione peroxidase, glutathione, and lipid peroxidation), and observed a significant decrease in lipid peroxidation (LPO) and restored the normal level of natural cellular enzymatic antioxidants (SOD, catalase and GPx) and the non-enzymatic antioxidant like GSH. Administration of *W. somnifera* showed a significant reversal of decreased SOD activity induced by various neuropathological conditions in the striatum ($P<0.00001$) and cerebellum ($P<0.00001$) of mice brain. Pretreatment with *W. somnifera* significantly reversed catalase activity in different parts of the rat brain, such as the striatum ($P=0.0001$), cortex ($P<0.0001$), and cerebellum ($P=0.003$). Administration of *W. somnifera* root extracts significantly increased the reduced levels of GSH in rat brain hippocampus and cerebral cortex ($P<0.00001$). *W. somnifera* extract reduced the increased LPO content in the hippocampus, cerebral cortex, forebrain, and rat brain homogenate ($P<0.00001$). *W. somnifera* contains many steroidal, alkaloids and lactones such as withanine, somniferine, with anyone, withaferin A, withanolide A, D, and G, glyco-withanolides (sitoindosides IX or sitoindosides X), etc. all of these active principles and metabolites play the active role in normalizing the various biomarkers of oxidative stress (Durg *et al*., 2015).

## 5. CONCLUSION

Medicinal plants were used in Ayurvedic therapy for a variety of illnesses. Traditional medicinal systems used ashwagandha root powder and extract, and a number of research conducted afterward have demonstrated the influence of phytoconstituents on the pathophysiology of numerous diseases in both human and animal medicine. Strong anti-inflammatory, antibacterial, hepatoprotective, antioxidative, immunomodulatory, hemopoietic, and neuroprotective effects can be obtained by administering *W. somnifera* root extract alone or in combination. More research is encouraged in the future to determine, the precise mechanism of action and therapeutic development.

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