



## Ashwagandha: A holistic approach to health and rejuvenation

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### Abstract

*Withania somnifera* (ashwagandha), a revered herb in traditional medicine, has gained significant attention in recent years for its potential health benefits. This systematic review and meta-analysis aimed to evaluate the efficacy and safety of ashwagandha in managing stress, enhancing cognitive function, promoting muscle strength, and contributing to general rejuvenation. The review analyzed 23 studies, including randomized controlled trials and cohort studies, with a total of 2,684 participants. Findings revealed that ashwagandha supplementation significantly reduced cortisol levels, alleviated anxiety, and improved cognitive performance, with moderate to large effect sizes (Cohen's  $d = 0.72$  for cortisol reduction, Cohen's  $d = 0.55$  for anxiety). Additionally, ashwagandha enhanced muscle strength and recovery, with a pooled effect size of 0.63. The safety profile was favorable, with minimal adverse effects reported. The results suggest that ashwagandha is a promising adaptogen with a broad range of therapeutic applications in stress management, cognitive health, and physical rejuvenation.

**Keywords:** *Withania somnifera*, ashwagandha, stress reduction, anxiety, cognitive enhancement, muscle strength, rejuvenation, adaptogen, clinical trials, systematic review

### Introduction

Ashwagandha (*Withania somnifera*), a prominent herb in traditional Ayurvedic medicine, has gained widespread attention in recent years for its potential therapeutic benefits. Known for its adaptogenic properties, ashwagandha is traditionally used to enhance vitality, reduce stress, and improve overall well-being. This plant, often referred to as Indian ginseng, has been employed for centuries in India and other parts of Asia to promote longevity, mental clarity, and physical rejuvenation. The increasing scientific exploration of ashwagandha has led to the identification of several bioactive compounds, including withanolides, alkaloids, and flavonoids, which are thought to contribute to its pharmacological properties. These compounds are believed to work synergistically to alleviate stress, reduce inflammation, support immune function, and improve cognitive function, thereby promoting holistic health.

Ashwagandha's adaptogenic effects have been of particular interest in modern clinical research. Adaptogens are substances that help the body adapt to stress and restore balance by modulating physiological responses. Studies suggest that ashwagandha can reduce cortisol levels, mitigate symptoms of anxiety and depression, and enhance resilience to physical and mental stressors. Recent clinical trials have provided evidence of its ability to enhance physical endurance, increase muscle mass, and improve overall vitality. This makes ashwagandha a potential aid for both mental and physical rejuvenation, aligning with its historical use as a general health tonic. Furthermore, the herb's safety profile has been considered favorable, with few side effects reported in clinical trials, enhancing its appeal as a natural supplement for long-term health maintenance.

The holistic approach to health and rejuvenation promoted by ashwagandha is not limited to its individual therapeutic benefits but extends to its role within the broader framework of Ayurvedic medicine. Ayurvedic practices emphasize the

balance between mind, body, and spirit, and ashwagandha fits into this paradigm as a tonic that supports overall harmony. The modern application of ashwagandha, however, is not confined to traditional Ayurvedic medicine but has also gained recognition in the fields of pharmacology, nutrition, and integrative medicine. The herb's potential to address a variety of health conditions, from chronic stress and anxiety to cognitive decline and inflammation, underscores its multifaceted role in health and wellness.

In light of these promising attributes, this paper aims to review the scientific evidence supporting the holistic health benefits of ashwagandha. By examining its pharmacological mechanisms, clinical applications, and traditional uses, we seek to provide a comprehensive understanding of how this ancient herb can contribute to contemporary health and rejuvenation practices.

### Materials and Methods

This study conducted a systematic review and meta-analysis of the available scientific literature on *Withania somnifera* (ashwagandha) to evaluate its therapeutic properties and holistic health benefits. A comprehensive literature search was performed in electronic databases, including PubMed, Scopus, and Google Scholar, using key terms such as "*Withania somnifera*," "ashwagandha," "adaptogen," "stress," "anxiety," "cognitive function," "muscle strength," and "rejuvenation." Studies published between 2000 and 2023 were considered for inclusion. Both preclinical and clinical trials that investigated the pharmacological effects, mechanisms of action, and safety of ashwagandha were reviewed. The inclusion criteria were set to focus on randomized controlled trials (RCTs), cohort studies, and meta-analyses. Only studies published in peer-reviewed journals and available in English were included. The data extracted from these studies included study design, sample

size, dosage and form of ashwagandha, primary outcomes related to stress reduction, muscle recovery, cognitive enhancement, and safety profiles.

For the analysis, data were compiled from studies that reported significant clinical outcomes related to the efficacy of ashwagandha in addressing physical and mental health concerns. Statistical analyses were performed using the software R (version 4.0) to assess the pooled effect size of ashwagandha supplementation on key outcomes. The heterogeneity of the studies was evaluated using the  $I^2$  statistic, and publication bias was assessed through funnel plots. A subgroup analysis was conducted to compare the effects of different dosages and formulations of ashwagandha. Additionally, the safety profile was examined by summarizing adverse events and dropout rates across the studies. This methodological approach ensures a rigorous evaluation of ashwagandha's therapeutic potential and provides insights into its role in holistic health and rejuvenation.

## Results

A total of 23 studies were included in the systematic review, comprising 18 randomized controlled trials (RCTs), 3 cohort studies, and 2 meta-analyses. The studies examined the effects of *Withania somnifera* (ashwagandha) on various health outcomes, including stress reduction, cognitive enhancement, muscle strength, and general rejuvenation. The sample sizes ranged from 30 to 200 participants, with a total of 2,684 individuals across all studies. The dosage of ashwagandha varied, with most studies using between 300 mg to 600 mg of standardized extract per day, administered in either capsule or powder form.

### Stress reduction and anxiety

A significant reduction in cortisol levels was observed in 13 studies that specifically measured the stress-reducing effects of ashwagandha. The pooled effect size indicated a moderate to large effect (Cohen's  $d = 0.72$ ,  $p < 0.01$ ) on lowering cortisol levels, a biomarker for stress. Additionally, 8 studies assessing anxiety levels demonstrated significant improvements, with a pooled effect size of 0.55 ( $p < 0.05$ ). The most prominent results were seen in individuals diagnosed with anxiety disorders, with reductions in the Generalized Anxiety Disorder Scale (GAD-7) scores ranging from 30% to 55% compared to placebo groups.

### Cognitive function and memory

Ashwagandha supplementation was associated with cognitive improvements in 6 studies, particularly in terms of memory and executive function. The pooled effect size for cognitive enhancement was 0.47 ( $p = 0.03$ ). One notable trial by Chandrasekhar *et al.* (2012) [2] demonstrated a 20% improvement in reaction time and memory recall in the treatment group compared to the placebo. Improvements in attention and task performance were also observed, with individuals in the ashwagandha group showing enhanced cognitive processing speed and better sustained attention.

### Muscle strength and physical rejuvenation

In 5 studies focusing on physical performance, ashwagandha supplementation significantly enhanced muscle strength and recovery. The pooled effect size for muscle mass increase was 0.63 ( $p = 0.01$ ), with participants demonstrating an average increase of 4.6 kg in lean body mass over 8 to 12 weeks. Strength gains were also reported, with the treatment group showing a 15% increase in bench press strength and a 20% increase in squat strength compared to placebo. A trial by Wankhede *et al.* (2015) [4] found that ashwagandha supplementation significantly improved muscle endurance, particularly in resistance-trained individuals.

### Safety and adverse events

Regarding safety, only 3 studies reported mild adverse events, including gastrointestinal discomfort and drowsiness, which were transient and resolved upon discontinuation of the supplement. The dropout rate across all studies was minimal, with less than 5% of participants discontinuing due to side effects. No serious adverse events were reported.

### Heterogeneity and subgroup analysis

The  $I^2$  statistic for heterogeneity in the studies on stress reduction was 60%, indicating moderate variability across studies. Subgroup analysis showed that higher dosages ( $\geq 600$  mg/day) were associated with greater reductions in cortisol levels and more pronounced improvements in cognitive and physical outcomes. No significant differences were found between different formulations (capsules vs. powder).

**Table 1:** The systematic review on *Withania somnifera* (Ashwagandha) based on the findings from the studies included

Outcome	Number of Studies	Sample Size (n)	Effect Size (Cohen's d)	Key Findings	P-Value	Notes
Stress Reduction (Cortisol Levels)	13	1,500	0.72	Significant reduction in cortisol levels in the ashwagandha group compared to placebo.	<0.01	Moderate to large effect on stress biomarkers.
Anxiety Reduction (GAD-7 scores)	8	1,000	0.55	Significant reduction in anxiety levels, with improvements of 30%-55% in GAD-7 scores compared to placebo.	<0.05	Prominent in individuals with anxiety disorders.
Cognitive Function (Memory/Attention)	6	800	0.47	Improved cognitive performance, including memory recall, reaction time, and attention.	0.03	Improvements in executive function and sustained attention.
Muscle Strength and Recovery	5	600	0.63	Significant increase in lean body mass (average 4.6 kg) and improvements in muscle strength (15%-20% increase).	0.01	Higher doses resulted in better muscle strength and endurance gains.
Safety (Adverse Events)	23	2,684	-	Mild adverse events reported in <5% of participants, including gastrointestinal discomfort and drowsiness.	-	No serious adverse events reported, dropout rate <5%.
Heterogeneity ( $I^2$ Statistic)	-	-	-	Moderate variability across studies on stress reduction ( $I^2 = 60\%$ ). Subgroup analysis showed higher doses were more effective.	-	Heterogeneity moderate across studies, especially in stress and anxiety outcomes.

This table provides a concise overview of the key findings from the systematic review, highlighting the number of studies, sample size, effect sizes, and statistical significance for each outcome. The results indicate the broad effectiveness of ashwagandha across multiple health outcomes, with particular benefits for stress reduction, cognitive enhancement, and muscle strength.

### Discussion

The findings from this systematic review highlight the significant therapeutic potential of *Withania somnifera* (ashwagandha) in promoting holistic health. Across various health outcomes, including stress reduction, cognitive enhancement, and muscle strength, ashwagandha demonstrated consistent and promising benefits. The moderate to large effect size for cortisol reduction (Cohen's  $d = 0.72$ ) and anxiety reduction (Cohen's  $d = 0.55$ ) are particularly notable, corroborating ashwagandha's role as an effective adaptogen in managing stress and anxiety. These results are consistent with previous studies, such as that by Chandrasekhar *et al.* (2012),<sup>[2]</sup> which reported a significant reduction in anxiety and stress symptoms among adults supplemented with ashwagandha, supporting the herb's anxiolytic and stress-reducing properties. Their study showed a substantial reduction in anxiety and cortisol levels, similar to the results observed in this review, reinforcing the herb's utility in managing stress-related disorders (Chandrasekhar *et al.*, 2012).<sup>[2]</sup>

The cognitive enhancement observed in this review, particularly in memory recall and executive function, adds to the growing body of evidence suggesting that ashwagandha may be beneficial in improving mental clarity and cognitive performance. In a study by Salve *et al.* (2013),<sup>[3]</sup> participants who took ashwagandha demonstrated significant improvements in sleep quality, mood, and cognitive function, echoing the findings of this review. Their study, which reported improvements in tasks requiring attention and memory, complements our findings and emphasizes the herb's potential in supporting cognitive health, particularly in individuals experiencing stress or age-related cognitive decline.

Furthermore, ashwagandha's effect on muscle strength and physical rejuvenation, with a pooled effect size of 0.63, aligns with the results of Wankhede *et al.* (2015),<sup>[4]</sup> who found that ashwagandha supplementation significantly improved muscle strength and endurance. In their randomized controlled trial, participants who received ashwagandha demonstrated greater increases in muscle mass and strength compared to the placebo group, particularly in resistance-trained individuals. The improvements in physical performance observed in this review further support the idea that ashwagandha may be an effective natural supplement for enhancing physical vitality, especially in athletes or individuals undergoing physical stress.

While the majority of the studies included in this review reported minimal adverse effects, with gastrointestinal discomfort and drowsiness being the most commonly reported, the safety profile of ashwagandha remains favorable. This finding is consistent with the study by Mishra *et al.* (2000),<sup>[1]</sup> which reviewed the safety and therapeutic potential of ashwagandha. Their review highlighted that ashwagandha is generally well-tolerated,

with rare occurrences of side effects, which supports its use as a long-term supplement for health and rejuvenation.

However, it is important to note that while the effect sizes reported in this review are moderate to large, the heterogeneity observed ( $I^2 = 60\%$ ) suggests variability across studies, which could be due to differences in dosages, formulations, and study populations. A subgroup analysis indicated that higher doses ( $\geq 600$  mg/day) were associated with more pronounced effects, particularly for stress reduction and muscle strength. This observation is consistent with findings from previous trials that suggest higher doses of ashwagandha may yield more significant therapeutic benefits (Wankhede *et al.*, 2015).<sup>[4]</sup> Future research with larger, more standardized sample sizes and consistent dosing strategies could further elucidate the optimal therapeutic dose and formulation of ashwagandha.

### Conclusion

This systematic review supports the therapeutic potential of *Withania somnifera* (ashwagandha) as an effective adaptogen in improving stress resilience, cognitive function, and physical performance. Ashwagandha supplementation showed significant benefits in reducing stress markers (such as cortisol), alleviating anxiety, enhancing cognitive performance, and improving muscle strength. The safety profile of ashwagandha was favorable, with minimal adverse effects reported across studies. While the results are promising, future studies with standardized dosages, larger sample sizes, and longer duration are necessary to better understand the optimal usage and efficacy of ashwagandha. These findings highlight the herb's potential for supporting both mental and physical well-being, contributing to its holistic health benefits in modern therapeutic applications.

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