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EFFECTS OF ASHWAGANDHA SUPPLEMENTATION ON PHYSICAL PERFORMANCE AND RECOVERY: A NARRATIVE REVIEW

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ABSTRACT

Ashwagandha (*Withania somnifera* L. Dunal) is an adaptogenic plant increasingly used by physically active individuals and athletes as a natural supplement intended to support exercise performance, recovery, stress regulation, and general well-being. The aim of this narrative review was to summarize current evidence regarding the effects of ashwagandha supplementation on physical performance and post-exercise recovery, with particular attention to muscle strength, aerobic capacity, anaerobic performance, body composition, cortisol response, sleep quality, and safety. A literature search was conducted using PubMed, Google Scholar, Scopus, and Web of Science. Randomized controlled trials, clinical studies, systematic reviews, meta-analyses, and relevant pharmacological studies were considered. Current evidence suggests that ashwagandha may improve selected aspects of physical performance, particularly muscle strength and VO_2max, especially when supplementation is combined with structured training and continued for several weeks. Some studies also indicate potential benefits for post-exercise recovery through reductions in creatine kinase activity, perceived muscle soreness, stress, and sleep disturbances. However, findings remain heterogeneous due to differences in extract standardization, dosage, intervention duration, training status, and outcome measures. Although short-term supplementation appears generally well tolerated, safety concerns, including rare cases of liver injury, should be considered. Further well-designed clinical trials are required to determine optimal dosing strategies and confirm the practical significance of ashwagandha supplementation in sport and physical activity.

KEYWORDS

Ashwagandha; *Withania Somnifera*; Physical Performance; Exercise Recovery; Adaptogen; Supplementation

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1. Introduction

Ashwagandha (*Withania somnifera* L. Dunal) is a plant belonging to the Solanaceae family. It is also known as Indian ginseng or winter cherry and has been used in traditional Indian medicine systems, especially Ayurveda, for thousands of years (Dar et al., 2015; Pandey et al., 2017). Ashwagandha is classified as an adaptogen, meaning a substance that may help the body maintain homeostasis when exposed to stress, fatigue, intense physical effort, sleep deprivation or psychological tension (Panossian & Wikman, 2010). Due to these proposed properties, scientific interest in this plant has increased in recent years (Pandey et al., 2017; Sprengel et al., 2025).

In the context of physical activity, this concept is particularly relevant because regular training exposes the body to repeated physiological stress. For this reason, ashwagandha is often considered by individuals seeking natural support for exercise adaptation, general well-being and recovery (Bonilla et al., 2021; Sprengel et al., 2025). The potential biological activity of ashwagandha is mainly associated with the presence of withanolides found in the root, stems and leaves of the plant, although alkaloids and other plant constituents may also contribute to its effects (Dar et al., 2015; Pandey et al., 2017).

Although ashwagandha is increasingly used by athletes and physically active individuals, the available evidence regarding its effects on physical performance and recovery remains heterogeneous. Differences in study design, supplement dosage, extract standardization, intervention duration and participants' training status make it difficult to draw clear conclusions (Bonilla et al., 2021; Sprengel et al., 2025).

Given the growing popularity of ashwagandha supplementation and the heterogeneity of available evidence, the aim of this narrative review is to summarize current findings on the effects of ashwagandha supplementation on physical performance and recovery. Particular attention is given to its potential impact on strength, endurance, VO_2max, fatigue, muscle recovery, stress response and sleep-related mechanisms.

2. Methodology

This article was designed as a narrative review. A literature search was conducted using PubMed, Google Scholar, Scopus, and Web of Science. The search terms included “ashwagandha”, “*Withania somnifera*”, “physical performance”, “exercise recovery”, “adaptogen”, and “supplementation”.

The review included randomized controlled trials, clinical studies, systematic reviews, meta-analyses, and relevant pharmacological studies concerning the effects, mechanisms, and safety of ashwagandha supplementation. Particular attention was given to studies involving healthy adults, physically active individuals, and athletes.

Studies were included if they assessed outcomes related to strength, endurance, aerobic capacity, power, body composition, recovery, stress response, sleep quality, or adverse effects. Articles not directly related to ashwagandha supplementation or not relevant to physical performance and recovery were excluded. Due to the narrative character of this review, the findings were summarized descriptively rather than statistically pooled.

3. Ashwagandha - characteristics and biologically active composition

The name “Ashwagandha” originates from Sanskrit and literally means “smell of a horse,” referring both to the characteristic odor of the root and the belief that its consumption imparts the strength and vitality of a horse. The Latin species epithet *somnifera* means “sleep-inducing” or “somniferous.”

In traditional medicine, ashwagandha has been used to improve vitality, sexual function, and memory, as well as to relieve pain, reduce stress, and alleviate rheumatic complaints. Ethnobotanical sources also report its use in the treatment of fever, constipation, ulcers, respiratory diseases, memory impairment, and “nervous exhaustion.” The root is the most commonly utilized part of the plant. In Africa, the leaves have traditionally been used for skin infections and inflammatory conditions, whereas in China the plant has been classified as a remedy that “tonifies qi and blood.”

Three major classes of bioactive compounds have been identified in ashwagandha: withanolides, alkaloids, and sitoindosides (Bashir et al., 2023; Girme et al., 2020).

Withanolides are C28 steroidal lactones possessing an ergostane skeleton. The most frequently described compounds include withaferin A, withanolide A, withanolide D, withanone, and numerous glycosides such as withanosides I–XII. The composition of this group is extensive, and new compounds continue to be identified (Abdelwahed et al., 2023; Mirjalili et al., 2009). The highest concentrations of withanolides are found in the roots of the plant (Kumar et al., 2023). Withanolides are considered the most important class of compounds from both chemical and pharmacological perspectives because of their anti-inflammatory, neuroactive, and anticancer properties (Abdelwahed et al., 2023; Gaurav et al., 2023; Tewari et al., 2022).

Another important group of bioactive constituents is alkaloids, which are particularly abundant in the roots of *Withania somnifera* (Abdelwahed et al., 2023; Premkumar, 2023). More than twelve alkaloids have been reported in the literature, although their concentrations vary among plant populations and plant parts. Commonly cited examples include withanine, anaferine, cuscohygrine, tropine, somniferine, and pseudo-withanine. The roots contain most of the alkaloids identified in ashwagandha. These compounds have primarily been associated with sedative and hypotensive effects (Gaurav et al., 2023; Sukumar, 2021).

Sitoindosides are glycosidic derivatives of withanolides, typically containing a glucose moiety attached at carbon C-27. Among those identified in the roots are sitoindosides VII, VIII, IX, and X (Gaurav et al., 2023; Mirjalili et al., 2009). This group is generally discussed together with withanolides and withanosides as part of the broader glycowithanolide profile of ashwagandha. Sitoindoside IX has also been isolated from the leaves and demonstrated selective inhibition of cyclooxygenase-2 (COX-2) as well as inhibition of lipid peroxidation in enzymatic assays (Jayaprakasam & Nair, 2003). In a morphine model, a mixture of sitoindosides VII–X combined with withaferin A reversed morphine-induced inhibition of intestinal transit and reduced the development of analgesic tolerance without exhibiting significant intrinsic analgesic activity (Jayaprakasam & Nair, 2003).

The pharmacokinetics of withanolides represent the best-studied aspect of ashwagandha. Clinical studies have investigated their absorption following single doses of standardized extracts and compared different formulations (Ramapalaniappan et al., 2025; Vaidya et al., 2023). These studies evaluated extracts standardized to contain between 2.5% and 40% withanolides and demonstrated that formulation significantly influences systemic exposure to these compounds (Kim et al., 2023; Ramapalaniappan et al., 2025; Sharma et al., 2025).

Short-term supplementation with standardized ashwagandha root extract in healthy adults is generally well tolerated; however, credible reports of liver injury and isolated signals regarding hormonal disturbances and risks in susceptible populations have been documented (Coope et al., 2026b; Philips et al., 2023). In clinical studies, participants receiving standardized root extracts were monitored for 8–12 weeks. The findings indicated that supplementation generally did not result in clinically significant changes in hepatic, renal, hematological, endocrine, or cardiovascular parameters. The most commonly reported adverse effects included gastrointestinal discomfort, nausea, headache, xerostomia, and transient drowsiness, although these symptoms were also observed in placebo groups (Coope et al., 2026b; Pakhale et al., 2026).

A rare but genuine risk of hepatotoxicity has been reported, most commonly presenting as cholestatic hepatitis. Although the condition is often self-limiting, severe cases and fatalities have been described in individuals with pre-existing liver disease (Vazirani et al., 2023; Williamson & Brendler, 2025).

In summary, standardized ashwagandha root extract appears to be generally well tolerated in short-term clinical studies. Nevertheless, supplementation is not free of risk, particularly for individuals with liver disease, autoimmune disorders, pregnancy, or endocrine abnormalities.

4. Potential mechanisms of ashwagandha action in athletes

Most clinical studies and systematic reviews indicate that ashwagandha may reduce cortisol levels in individuals experiencing stress, although the magnitude of this effect varies depending on the type of extract, dosage, and duration of supplementation. Reviews examining the effects of ashwagandha on stress and sleep most commonly report doses ranging from 250 to 600 mg/day, with supplementation periods typically lasting between 4 and 12 weeks.

A standard dosage frequently used in clinical studies is 300 mg twice daily, particularly when the therapeutic objective is to improve sleep quality, reduce tension, or support stress regulation. Some studies have also employed doses ranging from 500 to 1250 mg/day; however, these regimens are less standardized and therefore more difficult to compare across different preparations. In studies involving physically active individuals, different supplementation protocols have been used, which may partly explain the variability of reported outcomes (Bonilla et al., 2021; Jindal et al., 2025; Komorowski et al., 2025).

However, several limitations of the available reviews should be considered, including small sample sizes, the use of different formulations, and the lack of data regarding the effects of long-term cortisol reduction on adrenal gland function (Arumugam et al., 2024; Della Porta et al., 2023).

Randomized controlled trials have been conducted in adults reporting high levels of stress. Participants received supplementation for 30–60 days, after which cortisol concentrations were assessed. One randomized controlled trial reported an approximately 23% reduction in morning cortisol in the ashwagandha group (Lopresti et al., 2019). Nevertheless, further studies are needed to better establish the efficacy of this intervention and to determine optimal dosing strategies.

More recent studies also support the cortisol-lowering effects of ashwagandha, although they demonstrate considerable variability in outcomes. In a 30-day randomized controlled trial, a dose of 225 mg/day produced a statistically significant reduction in cortisol levels, whereas a dose of 400 mg/day resulted in a decrease that did not reach statistical significance (Remenapp et al., 2021). In 2024, a standardized extract administered at a dose of 125 mg/day for 8 weeks was also shown to reduce stress levels, an effect interpreted as modulation of the hypothalamic–pituitary–adrenal (HPA) axis (Pandit et al., 2024).

These findings suggest that modulation of the stress response and HPA axis may be one of the mechanisms through which ashwagandha could influence exercise adaptation and recovery. However, the translation of these mechanisms into measurable improvements in sport performance remains variable and should be interpreted in the context of study design, dosage, extract standardization, and participants' training status.

5. Effects of ashwagandha on physical performance

Ashwagandha supplementation is considered a natural form of support for physical performance. Current research indicates that it may affect various components of physical performance, such as muscle strength, cardiorespiratory endurance and maximal oxygen uptake. However, the current literature remains limited by relatively small sample sizes, differences in study design, various supplementation protocols and heterogeneity in participants' training status.

5.1. Effects on muscle strength

The component of physical performance most commonly associated with ashwagandha supplementation is muscle strength. In a randomized controlled trial, Wankhede et al. assessed the effects of eight weeks of ashwagandha root extract supplementation in 57 healthy young men with limited resistance training experience. Compared with placebo, ashwagandha supplementation resulted in significantly greater improvements in bench press strength and leg extension strength. The increase in bench press strength was 46.0 kg in the ashwagandha group compared with 26.4 kg in the placebo group, while leg extension strength increased by 14.5 kg and 9.8 kg, respectively. These results indicate that ashwagandha may enhance strength gains when used alongside resistance training (Wankhede et al., 2015).

Similar results were reported by Verma et al. in an eight-week randomized, double-blind, placebo-controlled study involving eighty physically active adults receiving either 600 mg/day of standardized ashwagandha root extract or placebo during resistance training. Ashwagandha supplementation produced greater improvements in upper- and lower-body strength compared with placebo. In particular, bench press strength increased more in the ashwagandha group than in the placebo group (11.0 ± 7.3 kg vs. 8.9 ± 6.3 kg), suggesting a potential benefit for strength adaptations during resistance training (Verma et al., 2024).

5.2. Effects on power and anaerobic capacity

The evidence regarding the effects of ashwagandha on power and anaerobic capacity is less extensive than that concerning muscle strength.

The study by Gierczuk et al. showed that ashwagandha did not significantly improve muscle strength in wrestlers, but it may have helped maintain anaerobic capacity and reduce fatigue-related declines during an intensive training period (Gierczuk et al., 2026).

Coope et al. found that 600 mg/day of ashwagandha for 42 days improved countermovement jump performance in male team sports athletes, increasing from 57.93 to 61.07 cm, while no significant improvements were observed in broad jump or clean lift. These findings suggest a possible benefit for selected lower-limb explosive power outcomes (Coope et al., 2026a).

Yadav evaluated the effect of ashwagandha supplementation on selected physical fitness variables in 20 male sprinters. After 12 weeks, the ashwagandha group showed better results than the control group in tests related to explosive power and anaerobic performance, including standing broad jump, 50-yard dash and shuttle run. The mean standing broad jump result was 2.683 m in the ashwagandha group compared with 2.071 m in the control group, while the 50-yard dash time was 6.276 s and 6.667 s, respectively. Shuttle run performance was also better in the ashwagandha group than in controls (9.668 s vs. 9.981 s). These findings suggest that ashwagandha may improve selected components of explosive power, speed and agility in sprinters, although the small sample size limits the strength of these conclusions (Yadav, 2015).

Jówko et al. evaluated the effects of 600 mg/day of ashwagandha supplementation combined with eight weeks of HIIT in 38 healthy men. Power at the anaerobic threshold improved in both groups, but the increase was not greater in the ashwagandha group than in the placebo group. Therefore, the study does not support a clear additional effect of ashwagandha on anaerobic threshold-related power (Jówko et al., 2025).

5.3. Effects on aerobic endurance and VO_2max

Several studies suggest that ashwagandha supplementation may have a positive effect on aerobic endurance and VO_2max. Shenoy et al. reported that eight weeks of ashwagandha supplementation improved cardiorespiratory endurance in elite Indian cyclists. The experimental group received 500 mg of ashwagandha twice daily, while the placebo group received starch capsules. VO_2max increased in the ashwagandha group from 46.2 to 52.0 mL/kg/min, whereas it remained almost unchanged in the placebo group. Time to exhaustion and MET values also improved only in the ashwagandha group, suggesting a beneficial effect on aerobic capacity and endurance performance (Shenoy et al., 2012).

Choudhary et al. reported that 12 weeks of ashwagandha root extract supplementation significantly improved cardiorespiratory endurance in healthy athletic adults. The increase in VO_2max was greater in the ashwagandha group than in the placebo group after 12 weeks (5.67 vs. 1.86), indicating a potential beneficial effect on aerobic capacity (Choudhary et al., 2015).

Pérez-Gómez et al. conducted a systematic review and meta-analysis including five studies with 162 participants. The authors found that ashwagandha supplementation significantly improved VO_2max compared with placebo, with an average increase of approximately 3.0 ml/kg/min. These findings suggest a potential beneficial effect on aerobic capacity, although the limited number of studies and differences between study protocols require cautious interpretation (Pérez-Gómez et al., 2020).

5.4. Effects on body composition

The effect of ashwagandha on body composition remains unclear. Wankhede et al. reported that eight weeks of ashwagandha supplementation combined with resistance training resulted in a greater reduction in body fat percentage compared with placebo (3.5% vs. 1.5%). The study also showed greater increases in muscle size, particularly in the arms and chest, suggesting that ashwagandha may support favourable body composition changes when combined with resistance training (Wankhede et al., 2015).

However, these findings have not been consistently confirmed in later studies. Verma et al. observed greater improvements in selected muscle-related circumferences after eight weeks of supplementation with 600 mg/day of standardized ashwagandha root extract. Mid-arm circumference increased more in the ashwagandha group than in the placebo group (1.5 ± 0.5 cm vs. 1.2 ± 0.5 cm), and chest circumference also showed a greater increase (3.6 ± 1.9 cm vs. 2.5 ± 1.3 cm). However, body fat percentage decreased similarly in both groups (-1.7% vs. -1.7%), indicating no additional fat-reducing effect of supplementation (Verma et al., 2024).

In professional wrestlers, Długołęcka et al. reported increases in fat-free mass and muscle mass, together with reductions in fat mass, in both the ashwagandha and placebo groups after eight weeks of intensive training. However, ashwagandha supplementation at 600 mg/day did not produce significant additional changes in body composition compared with placebo (Długołęcka et al., 2023). Similarly, Charmas et al. found no significant effect of 600 mg/day of ashwagandha on body composition in healthy young men undergoing an eight-week HIIT program (Charmas et al., 2025).

Overall, the available evidence suggests that ashwagandha may support improvements in muscle-related parameters, especially when combined with resistance training. Its effect on body fat reduction is less clear. Apart from the greater decrease in body fat percentage reported by Wankhede et al. (3.5% vs. 1.5%), later studies have not confirmed a consistent independent effect of ashwagandha on fat loss (Charmas et al., 2025; Długołęcka et al., 2023; Verma et al., 2024; Wankhede et al., 2015).

6. Effects of ashwagandha on post-exercise recovery

Intense physical exercise leads to microdamage to muscle fibres, accompanied by a temporary increase in markers of muscle damage and a decline in muscle performance. For this reason, substances that may support post-exercise recovery are being investigated, and one such adaptogen is ashwagandha (*Withania somnifera*). Wankhede et al. assessed exercise-induced muscle damage in 50 men following 8 weeks of regular resistance training. Participants were randomly assigned to receive either placebo ($n = 25$) or 600 mg/day of ashwagandha ($n = 25$). Changes in serum creatine kinase (CK) activity were measured as an indirect marker of muscle damage 24 and 48 hours after both the first and the final training sessions. A smaller increase in CK activity is indicative of reduced muscle damage and improved recovery. Both groups demonstrated lower post-exercise CK levels after 8 weeks of training, suggesting adaptation to exercise-induced muscle damage; however, the reduction was significantly greater in the ashwagandha group than in the placebo group ($p = 0.03$). These findings support the potential adaptogenic and recovery-enhancing effects of ashwagandha. Nevertheless, the results should be interpreted with caution due to limitations including the relatively small sample size (50 participants) and the short duration of follow-up (Wankhede et al., 2015).

High levels of physical activity can lead to delayed-onset muscle soreness (DOMS), particularly in muscles unaccustomed to regular intense exercise. The most common cause of DOMS is strenuous eccentric exercise. The primary symptoms include muscle tenderness, pain during active movement, and stiffness (Meamarbashi, 2017). There are relatively few studies directly investigating the effects of ashwagandha on DOMS. In a recent randomized placebo-controlled trial involving 56 athletes, supplementation with 600 mg of ashwagandha extract daily for 42 days resulted in significant improvements in recovery-related parameters among female participants, including a reduction in DOMS severity assessed using the Hooper Index, compared with placebo (Coope et al., 2026a). These findings suggest the possibility of sex-specific differences in the response to ashwagandha supplementation and highlight the need for further studies involving larger cohorts of athletes.

Exercise-induced muscle damage is accompanied by an inflammatory response and increased production of reactive oxygen species, which contribute to oxidative stress. While these processes are necessary for tissue repair and adaptation, excessive inflammation and oxidative stress may impair recovery and subsequent athletic performance (Paul et al., 2021; Stožer et al., 2020).

Ashwagandha has been shown to possess both anti-inflammatory and antioxidant properties, largely attributed to its bioactive constituents known as withanolides. Experimental and clinical studies suggest that these compounds may suppress the production of pro-inflammatory cytokines, including interleukin-6 (IL-6) and tumour necrosis factor alpha (TNF-α). In addition, ashwagandha may enhance endogenous antioxidant defence systems by increasing the activity of enzymes such as superoxide dismutase (SOD), catalase, and glutathione peroxidase (GPx). Through these mechanisms, supplementation may help attenuate exercise-induced oxidative stress and support post-exercise recovery.

Although the available evidence is promising, further well-designed clinical trials are required to establish the magnitude and practical significance of these effects (Paul et al., 2021).

Sleep plays a fundamental role in post-exercise recovery, contributing to muscle protein synthesis, hormonal regulation, immune function, and restoration of the central nervous system. Impaired sleep quality or insufficient sleep duration may negatively affect recovery processes, increase perceived fatigue, and reduce subsequent exercise performance. Therefore, interventions that improve sleep may indirectly enhance overall recovery in physically active individuals. Evidence suggests that ashwagandha may exert beneficial effects on several sleep-related parameters. In a randomized, double-blind, placebo-controlled trial, Langade et al. demonstrated that 10 weeks of supplementation with ashwagandha root extract significantly improved sleep quality, reduced sleep onset latency, and increased sleep efficiency compared with placebo in individuals with insomnia and anxiety. These improvements were accompanied by reductions in anxiety scores, suggesting a potential role of ashwagandha in supporting both psychological and physiological aspects of recovery (Langade et al., 2019).

Based on these findings, it may be hypothesised that improved sleep quality represents an additional mechanism through which ashwagandha could support post-exercise recovery. Given the central role of sleep in tissue repair, endocrine regulation, and neuromuscular restoration, the sleep-promoting effects of ashwagandha may indirectly contribute to enhanced recovery from physical exertion.

Recovery from exercise is influenced not only by physiological processes but also by psychological factors, including perceived stress, mental fatigue, and subjective readiness to perform subsequent training sessions. Elevated levels of psychological stress may impair recovery by increasing fatigue perception, disrupting sleep, and altering hormonal responses, particularly through sustained elevations in cortisol (Chandrasekhar et al., 2012; Lopresti et al., 2019).

Several studies have demonstrated that ashwagandha supplementation may improve psychological well-being and reduce stress-related symptoms. In a randomized, double-blind, placebo-controlled trial, Chandrasekhar et al. reported significant reductions in perceived stress scores and serum cortisol concentrations following supplementation with a high-concentration ashwagandha root extract compared with placebo (Chandrasekhar et al., 2012). Similar findings were reported by Lopresti et al., who observed improvements in stress, mood, and self-reported fatigue among adults receiving ashwagandha supplementation. Additionally, participants receiving ashwagandha exhibited significant reductions in anxiety scores, morning cortisol, and DHEA-S concentrations compared with placebo, without any reported adverse effects (Lopresti et al., 2019).

Collectively, these findings suggest that ashwagandha may improve subjective recovery by reducing psychological stress and mental fatigue, although direct evidence in athletic populations remains limited.

7. Conclusions

The available evidence suggests that ashwagandha (*Withania somnifera*) may support selected aspects of physical performance and post-exercise recovery, although its effects are not uniform across all outcomes. The most consistent findings concern improvements in muscle strength and aerobic capacity. Several studies indicate that supplementation may enhance strength adaptations during resistance training and may increase VO_2max in physically active individuals and athletes. However, the evidence regarding anaerobic capacity, explosive power, and body composition is less consistent. Some studies suggest improvements in selected power-related outcomes, whereas others do not confirm an additional effect of ashwagandha beyond regular training.

The effect of ashwagandha on body composition also remains unclear. Improvements in muscle-related parameters have been reported, particularly when supplementation was combined with resistance training, but a consistent independent effect on fat loss has not been confirmed. Therefore, ashwagandha should not be interpreted as a direct body fat-reducing supplement.

Ashwagandha may also contribute to recovery through several complementary mechanisms. The reviewed studies suggest possible reductions in creatine kinase activity, perceived muscle soreness, psychological stress, cortisol levels, and sleep disturbances. These effects may be related to the adaptogenic, anti-inflammatory, antioxidant, and sleep-promoting properties of the plant. However, much of the evidence concerning recovery remains indirect or based on relatively small studies, and direct research in athletic populations is still limited.

Overall, ashwagandha appears to be a promising supplement for physically active individuals, particularly in the context of strength development, aerobic performance, stress regulation, and recovery support. Nevertheless, the current evidence is limited by small sample sizes, heterogeneity of study designs, differences in extract standardization, dosage, intervention duration, and participants' training status. Short-term supplementation with standardized root extract appears to be generally well tolerated, but potential adverse effects, including rare cases of liver injury, should be considered.

Further well-designed randomized controlled trials are needed to determine optimal dosage, duration of supplementation, long-term safety, and the practical relevance of ashwagandha use in sport and exercise settings.

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