



REVIEW ON ERGOGENIC EFFECT OF WITHANIA SOMNIFERA (L.) DUNAL

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ABSTRACT

Withania Somnifera (L.) Dunal is a commonly used herb in the alternative medical systems in the world. It is been investigated under several aspects of sports science due to athlete friendly benefits. The collective traits of performance enhancing consequence of an athlete can be described under the term 'ergogenic effect'. Though the herb is not been investigated as an ergogenic aid, the scattered scientific studies can preview its' skill, strength, endurance and recovery promoting ability after competitions. The study was aimed to analyze its' ergogenic effect using scientific evidences and classical Ayurveda references. Research data was collected from the online sources and classical Ayurveda references. *Withania Somnifera* found to be enhanced aerobic and anerobic exercise capacity, muscle strength, recovery process, anti-fatigue activity, endurance and immune-modulatory effect. Ayurveda literature also supports these evidences as it has been described as a *Balya*, *Brimhana*, *Vatahara*, *Kaphahara* and *Shukrala* herb. Correlation between these two concepts also suggests *Withania Somnifera* as an effective ergogenic aid.

Keywords: *Withania somnifera*, *Ashwagandha*, ergogenic, athletes' performances

INTRODUCTION

Ever-rising attractiveness of sports has created industrial overlook and professionalisms for sports. Yet, true spirit is depending upon the performances of athletes. Alternatively, good health and nutrition are equally responsible to explicit their essence in the competition flat form. This inter-relationship influences the healthcare providers to seek nutritional supplements for athletes to enhance their performances. Using drugs which possess enhancing effect of performances are considered unethical and illegal as per the rules and regulations of the International Olympic Committee (IOC)¹. However, maintenance of nutritional status to boost up their competition levels is an essential requirement of professional athletes. As a result, the IOC has published a list of banned drugs for athletes in 1963 for the first time, allowing the safe use of supplements². Hence, herbs came as a better option due to their safety and cost-effectiveness. Among the herbal plants been researched in sports medicine, *Withania somnifera* (L) Dunal has taken a valuable focus as it has a well-documented history on its vitality properties. *Withania somnifera* (L) Dunal (WS) is commonly known as ‘Winter cherry’ or ‘Indian ginseng’. It is a widely used medicinal herb in Ayurveda as well as alternative medical systems. The Sanskrit name of this valuable plant is *Ashwagandha*. The term denotes ‘horse smell’. Crushed leaves and roots resemble the urine odor of horse and hence named as ‘*Ashwagandha*’. It is believed that the consumption of *Ashwagandha* also gives the power like a horse. Alternatively, the Latin term of the species ‘*somnifera*’ means ‘sleep inducing’ and represents its sedative attribute.

- Latin name - *Withania somnifera* (L.) Dunal/ *Physalis somnifera*
- Family- Solanaceae
- Classical name- *Ashwagandha*
- Sanskrit Synonyms- *Ashvavarshaka*, *Balada*, *Gandhapatri*, *Haya*, *Hayagandha*, *Hayapriya*, *Kamarupini*, *Kushthagandha*, *Kushthagandhini*, *Palashaparni*, *Priyakari*, *Punya*, *Pushtida*, *Push-Tipavira*, *Rajgandha*, *Turangagandha*, *Va-*

jigandha, *Vajigandhika*, *Vajikari*, *Varada*, *Varahakarni*, *Vataghni*

- Habit- Perennial shrub, grows usually 2 feet height
- Habitat-Cultivated in dry regions in India including Rajasthan. Naturally, it can be found in dry and waste areas ranging from Africa, Mediterranean and east India.
- Parts used - Root, leaves, fruits & seeds

WS is one of the main drugs used in Ayurveda as well as other traditional medical systems in India. Ayurveda references provide a trace of its history beyond 3000 and 4000 years through the ancient texts including *Caraka samhita*, *Shusruta samhita* and *Ashtangahrda samhita*. It is a delicate plant native to south Asian countries like India, Sri Lanka and Pakistan. Hence, it can be found abundantly in traditional medical systems of these countries. It is been used in fever and inflammatory diseases by the tribal people of Africa³. Uses of this plant can be found in *Ashwalayana grahya sutra* and *Shatapata brahmana* like ancient texts belong to *vedic* period in India⁴. Yet, there is no any description found in *Aranyaka* and *Upanishad* texts. There are some references of *Ashwagandha* in *Garuda purana*, *Agnipurana* in the purposes of *ra-sayana* (rejuvenating) and *vajeekarana* (aphrodisiac)⁴. It is given an immense important as a preventive herb as well as a therapeutic herb after the period of 1500BC in *samhita* period in the chronological order of the Indian scriptures.

Ashwagandha is distinguished as a rejuvenating drug in Ayurveda. It also promotes *bala* (strength) and *shukra* (fertility). The plant extracts and bioactive compounds of WS have been researched for many diseases like infertility, arthritis, carcinomas, and diseases related to neurons, hormones and heart. It is an adaptogen herb which has the ability to adapt in certain physiological alterations of body.

In sports medicine, the term ‘ergogenic aids’ is been used for the drugs which provide support to increase performances and recovery by means of mechanical, nutritional, pharmacological, physiological or psychological tool⁵. Alternatively, strength promoting action

and adaptogen action are the main aspects of an ergogenic aid. These properties naturally found in WS. It gives eventual popularity for WS in the sports medicine. Hence, the purpose of this study is to compile the available scientific evidence of WS to find its applicability in sports medicine as an ergogenic aid.

Aim and objectives

1. To compile the scientific data and Ayurveda properties of WS that interrelated to sports medicine.
2. To analyze the evidences to find the capabilities of using WS as an ergogenic aid.

Methodology

The scientific data was collected from online databases. The key words used for browsing were '*Withania somnifera*', '*Ashwagandha*', 'performance enhancing', 'ergogenic aids' and 'strength promoters'. All the review articles, in-vivo, in-vitro and randomized clinical trials were studied. Relevant articles to the topic were extracted after careful review. Conceptual references of Ayurveda were collected from the authentic texts. Extracted data was analyzed to find the applicability of WS in sports medicine as an ergogenic aid.

Results and analysis

Results and analysis have been conducted in two ways. They are,

- compilation of scientific data of WS in relation to sports medicine and
- analysis of Ayurveda properties of WS that support to enhance performances of athletes.

❖ Scientific data of WS in relation to sports medicine

There are four main aspects are being considered in the performances of athletes: skill, strength, endurance and recovery. Inborn skills can be sharpened through proper training. Training enhances strength, and endurance. Recovery will depend upon the proper nutrition and proper training. Hence, athletes are prone to use supplements to improve their strength, and recovery process after exercises.

Effect on aerobic exercise capacity and Cardio-pulmonary system: Aerobic exercise capacity is an important part of the competitors' success. It helps to

sustain the physical strength without being fatigue. VO₂ max is a measure of long-term aerobic and cardiovascular endurance⁶. It was observed that a significant increase in VO₂ max after 12 weeks *Ashwagandha* supplementation⁶. Eight-week supplementation of *Ashwagandha* aqueous root extract 500mg twice daily on athletes also improved 13% of VO₂ max (maximum oxygen consumption). It is suggested that increased RBC and Hemoglobin level as the cause for the aerobic capacity⁷. An in-vivo study revealed its' prolonged hypotensive effect, bradycardiac effect and stimulatory effect on respiratory system of dogs and frogs⁸. The cardio protective effect also been shown in an experimental model of myonecrosis in isoprenaline-induced rats. The study was further suggested that augmentation of endogenous antioxidants, maintenance of the myocardial antioxidants status and restoration of altered hemodynamic parameters can be contributed for this effect⁹. WS has validated on its' effectiveness on cardio-pulmonary disorders with preventive dose of 50 and 100 mg/kg/day of root powder¹⁰.

Increase Hemoglobin (Hb) and Red blood cells (RBC): The main mechanism of transporting O₂ is Hb-O₂ affinity. Oxygen transport capacity has a direct correlation with aerobic performances. Hb is responsible for maximum uptake of O₂ (VO₂ max). Hence, O₂ carrying capacity or Hb amount have significant advantages in aerobic performances of athletes.

Ashwagandha improves hemoglobin level significantly in athletes¹¹. It has proven by an experiment by giving 500mg *Ashwagandha* capsule twice a day for 8 weeks to 16 professional hockey players. Thereby, WS improves both VO₂ max and exercise capacity as well¹².

Effect of WS on anaerobic performance of athletes: 'Anaerobic' means 'without oxygen', which does not need oxygen as a fuel and use the energy sources within the contractile muscles. Hence, it provides intense physical activity for a short period⁷. This anaerobic system responds to high intensity training with biochemical, neural and anatomic adaptation¹³, and it helps to utilize the unused or less used stored energy sources of the muscles. Ability of utilization of power

helps to athletes to space out from other competitors. Hence, WS is been studied for its' anaerobic capacity in trained athletes.

When randomly selected 40 elite cyclists received supplementation of aqueous extract of WS roots for 8-week, anaerobic parameters were increased significantly except velocity. It also proved that WS increases the anaerobic performances equally in both genders¹⁴.

Effect on muscle strength and recovery: Muscular strength is defined as the ability to exert force on an external object or resistance¹⁵. This external mechanical power depends upon the sum of all the joint powers. Studies have shown that external mechanical power directly related to the athletes performances¹⁵. There was a statistical significance in improvement of muscle strength and muscle size when consumed 300mg WS root extract twice daily for 8 weeks. The study was conjugated with a resistant training program. Further, the study was revealed that body fat composition was decreased significantly along with significant increase of testosterone hormone level. It also proved regarding the recovery effect of exercise induced tissue damage. Tissue damage was evaluated by serum creatinine kinase value¹⁴. Another study had shown that, 500mg aqueous extract of *Ashwagandha* improves upper and lower body strength and it is tolerated in clinically recreationally active men over a 12-week resistance training¹⁶. It also reported that, significant increase of body weight in rats when treated *Ashwagandha* for 3 months. Hence, it can be suggested that WS increases the body weight but decrease the body fat composition¹⁴.

Adaptogen effect and anti-fatigue action: Adaptogen effect is an essential component for enhancing physical performances. It helps to overcome fatigue in extreme physical and mental stress. This is the most essential action needed in athletes. Researchers have contrasted the adaptogens against stimulators or doping used in sports medicine. While adaptogens are working as regulators, stimulators give an increase of physical capacity for a short period. Stimulators reduce working capacity after the peak level. Yet, adaptogens show a constant performance¹⁷. One study re-

vealed a significant increase of plasma corticosteron level, phagocytic index, and avidity index in the pre-treated rats by aqueous suspension of *Ashwagandha* root at 10mg/Kg oral dose. The evaluation was held when they were subjected to cold swimming stress¹⁸.

When WS root extract 25 or 50 mg/kg/ po has given daily for 21 days in chronic stress induced adult Wistar rats, they showed similar adaptogen effect like *Panax ginseng*¹⁹.

Anti - Anxiolytic Property: Stress is a non-specific response to any change of the body²⁰. Stress can be positive or negative with relation to the sports performances. Since, stress up to a certain level helps to athletes to prepare and focus on their goal as well as to perform in the optimal level. When stress exceed to a higher level it causes anxiety and lack of confident. Most of the adaptogen herbs can work on stress related disorders. WS also been investigated for its anti-stress activity in many studies. A double-blind placebo-controlled trial showed a significant reduction of anxiety disorders²¹. Studies have shown a greater reduction of anxiety; morning cortisol level, c-reactive proteins, pulse rate and blood pressure in chronic stress when patients received *Ashwagandha* extract 125 mg twice daily for 8 weeks in a double-blind randomized placebo controlled trial²¹. Some preclinical studies also proved that *Ashwagandha* can influence the GABAergic activity and serotonin activity to improve anxiolytic and anti-depressant activity¹⁸.

Professional athletes and endurance athletes are having long-term cortisol or stress hormone elevation in the blood due to continuous intense training. It leads to proteolysis and further developed into muscle wasting; it suppresses the immune system and triggers the mental issues like mood swings, anxiety and depression. Hence, it is very much needed to consume adaptogen herbs like WS to prevent stress, anxiety and depression.

Physical Endurance: Endurance supports athletes to work out for a long period. It can be either cardiopulmonary or muscular. Muscular or physical strength helps to sustain repetitive contractions of the muscles. There was a study that used a swimming test to evaluate physical endurance in rats. In this study *Ashwa-*

gandha treated animals showed significant results in swimming time compared to the control group¹⁸.

Another study was revealed that *Ashwagandha* can influence the mitochondria granulation and MG 2+ dependent ATPase activity in the mitochondria granulation tissue¹⁸. Mitochondrial granulation is responsible to sustain the muscle contractions.

Immuno-modulatory effect: *Vyadhikshamatva* or immunity has a correlation with constitutional health²². Strenuous exercises cause to transient suppression in various aspects of immunity. Further, long lasting intensified exercises may depress immune functions for 1 week or more²³. WS is being studied for its' immune modulatory functions by many researchers. Powdered root of WS was found to be stimulated immunological activity in Babl/c mice. It is also found that five doses of WS root powder enhanced the total WBC count. Not only that, bone marrow cellularity as well as alpha-esterase positive cell number also increased significantly²⁴.

Antioxidant Property: Exercise increases oxygen utilization and thereby it increases the leakage of reactive oxygen species. This leads to muscle damage and immunity dysfunctions of the body. Studies have shown that, antioxidant supplementation is helpful to

reduce reactive oxygen species produced by the exercise induced oxidative stress²³. Hence, antioxidant supplementation is essential for the athletes to recover their body functions after competitions and vigorous exercises. WS possess a high level of antioxidants capacity. Studies have shown potent antioxidants properties of all the extracts of root, leaf and stem of WS. It also revealed that Methanol extracts of WS had the strongest radical scavengers' activity²⁵. Hence; *Ashwagandha* delivers a restorative effect after exercise.

Further, studies have discovered a potent ergogenic effect of WS same as caffeine. It also has a similar effect like *Panax ginseng* due to parallel biological properties between ginsenosides in ginseng and withanolides in WS⁸.

Apart from the properties described in this study, WS has more evidence-based properties like Anti-inflammatory, Anti spasmodic, Antitumor effect etc. (table 1). These are not related directly to the ergogenic effect. However, they help to bring the body functions to normal level after strenuous exercises and competitions. It helps to enhance their overall working capacity as well.

Table 1: Indirect pharmacological activities influencing the ergogenic effect of WS⁸

Anti-inflammatory property
Anti –tumor activity
Haemopoetic effect
Anti-spasmodic effect
Hypotensive effect
Respiratory stimulant activity
Anti-ulcer genic activity
Cognition promotion effect
GABA mimetic effect
Anti-arthritis effect

Chemical composition: The main active biological compound of WS is alkaloids. And it also contains steroidal compounds including ergostane type steroidal lactones, withaferin A, withanolides A-y, Withasomniferin – A, Withanane. Apart from these chemicals, it also contains variety of saponins, glycosides, starch, reducing sugar etc. The main active in-

redient for the significant actions of the plant is Withanolides. Yet, studies have shown that sleep inducing capacity delivers by the Triethylene glycol concentration and that is high in WS leaves comparing to roots²⁶.

❖ **Analysis of Ayurveda properties of WS:**

Ayurveda maintains the health of healthy individuals as one of the main goals. It upholds the constitutional, physiological and psychological equilibrium of *shareera*. This is been described extensively as *rasayana* (rejuvenation) and *vajeekarana cikitsa* (aphrodisiac) in Ayurveda. *Acaryas* have given immense important for these aspects by imparting them as separate sections in *Ashtangaayurveda*. Further, a statement of *Punarvasu Atreya* mentioned in *Caraka*

samihta explicates the importance of *rasayana cikitsa*²⁷. He emphasized that *rasayana cikitsa* helps to promote life, maintain positive health, preserve youth, and to cure morbid sleep, drowsiness, laziness, and weakness. It relieves physical and mental fatigue. Additionally, he explained about *rasayana* drugs and mentioned that they enhance the compactness and stability of the muscles²⁷. Thereby, it provides strength to the body. Being WS a *rasayana* dug as shown in the table no.2, it enhances the strength of the body.

Table 2: Common formulations of *Ashwagandha* used for *balya*, *rasayana* and *vajikarana*

	<i>Caraka Samhita</i>		<i>Sushruta samhita</i>		<i>Ashtanga hrída</i>	
	Name of the formulation	Reference	Name of the formulation	Reference	Name of the formulation	Reference
01	<i>Vajikarana grita</i>	C.ci.2-1/34	<i>Maha bala taila</i>	Su.ci.5/10	<i>Vidarigandadi rasayana</i>	AH .u.39/61
02	<i>Utsaadanarta aushadha dravya</i>	C.ci.8/176	<i>Bala tiala</i>	Su.ci.15/33	<i>Nanavrishya yoga</i>	AH.u.40/11
03	<i>Mushaka taila</i>	C.ci.28/173	<i>Ashwagandhadi ksheera</i>	Su.u.41/43	<i>Phalagrita</i>	AH.u.34/64
04	<i>Baladi anuvasana basti</i>	C.ci.28/173	<i>phalagrita</i>	Su.u.62/28	<i>Ashwagandhadi grita</i>	AH.ci.5/25
05			<i>Ashwagandhadi curna</i>	Su.u.41/42	<i>Bala taila nirupana</i>	AH.s.2/50
06			<i>Ashwagandhotsa danamvasa grita</i>	Su.u.41/44		

Apart from that, *acarya Caraka* has explained two types of *bheshaja* (drugs) in the chapter of *rasayana*²⁷. They are,

1. *Swasthasya urjaskara bheshaja* – drugs that fortify the health of healthy person
2. *Arthasya roganut bheshaja*– drugs that have curative ability in diseases

Further, he categorized *rasayana* and *vajikarana* drugs under the *swasthasya urjaskara bheshaja*²⁸ It is undoubtedly evident by its synonym *prakrithi sthapanā*²⁸; denotes its ability to maintain normal status. It can be understood by the adaptogen activity of *rasayana* drugs; thereby of *Ashwagandha*. Not only that,

strength or *shareera bala* re-establishing potency of *Ashwagandha* had been used by the ancient *acaryas* by prescribing this herb in *Rajayakshma*²⁹(tuberculosis) and *Shosha pratishedha cikitsa*³⁰(prevention of wasting diseases). This facet is accommodating the recollect of strength of athletes after training sessions and the competitions. Hence, these traits described in Ayurveda can be applied for the athletes in laterally; along with their customized requirements for achieving the optimal performances; as *acarya Caraka* stated, appropriate *cikitsa* can be applied by inquiring *dosha*, *dhatu* and *mala status* of *purusha*³¹.

Table 3: Classifications of *Ashwagnadha* in Ayurveda

Name of the text	Classification under <i>varga</i> (grouping)	References
<i>Caraka samhita</i>	<i>Balya, Brimhaneya maha kashaya, Madhura skanda, Mula asava yoni</i>	<i>sutra -4-8/2,4-9/7, 25-48/7</i> <i>vimana - 8/139</i>
<i>Sushruta samhiata</i>	<i>Urdhava bhagahara dravya</i>	<i>sutra - 39/3</i>
<i>Ashtanga samhira</i>	<i>Brumhaneeya and Balya maha kashaya, Madhuara skandha</i>	<i>sutra -15/7,15/12,18/20</i>
<i>Ashtanga Nighantu</i>	<i>Shyamadi gana</i>	226
<i>Dhanvantari nighantu</i>	<i>Guduchyadi varga</i>	1/262-263
<i>Madanapala nighantu</i>	<i>Harithyakadi varga</i>	1/173-4
<i>Kaiyadeva nighantu</i>	<i>Aushadhi varga</i>	1/1044-46
<i>Bhavaprakasha nighantu</i>	<i>Guduchaydi varga</i>	3/189
<i>Raja nighantu</i>	<i>Shatahyyadi varga</i>	109-112
<i>Nighantu adarsha</i>	<i>Kantakaryaadi varga</i>	394
<i>Priya nighantu</i>	<i>Shatapushapadi varga</i>	3/110

Ashwagandha is one of the herbs which have wide spread of pharmacological properties¹¹. It is included as an ingredient in many Ayurveda formulations other than the formulations mentioned in the table 2. It is also been mentioned as a herb under different *karmas* (action) like *balya* (strength promoting) and *brimhana*

(bulk promoting) and also under different drug groups (Table 3). These different attributes of *Ashwagandha* collectively allows the undisturbed nutritional pathway up to the finest level of the body. Thereby, it helps to produce quality *dhatu*s (tissue) in the body. It regenerates exhausted and damaged tissues of athletes.

Table 4: *Karma* (actions) of *Ashwagandha* according to Ayurveda texts

	<i>Karma</i>	<i>Dh.Ni</i>	<i>K.Ni</i>	<i>R.Ni</i>	<i>BP.ni</i>	<i>Ni. Rat</i>	<i>MV ni</i>	<i>Pr.ni</i>	<i>MD ni</i>	<i>Mad dg</i>	<i>Rv ni</i>
01	<i>Balya</i> (strengthening)	+	+	+	+	+	+	+	+	+	+
02	<i>Pushtiprada</i> (bulk promoting)	-	+	-	-	+	-	-	-	-	-
03	<i>Kaphahara</i>	+	+	-	+	+	+	-	+	-	-
04	<i>Vatahara</i>	+	+	+	+	+	+	+	+	+	+
05	<i>Vrishya</i> (aphrodisiac)	+	+	-	-	+	-	+	-	-	+
06	<i>Rasayana</i>	-	+	-	+	-	+	+	+	-	+
07	(rejuvenating)										
08	<i>Kanti vardhaka</i> (promote complexion)	+	-	-	-	+	-	-	-	-	-
09	<i>Shukrala</i> (increase sperm)	-	-	-	+	-	+	-	+	-	-
10	<i>Jaravyadhi nashana</i> (anti-ageing)	-	-	-	-	+	-	-	-	-	-
11	<i>Dhatu vriddhikara</i> ()	-	-	-	-	+	-	-	-	-	-

(Dh.Ni- Dhanwantari nighantu, K.Ni- Kaiyadeva nighantu, R.Ni- Raja nighnatu, BP.ni- Bhavaprakasha nighantu, Ni. Rat - Nighantu Ratnakara, MV ni - Mahaaushadha nighantu, Pr.ni – Priya nighantu, MD ni –Madanapala nighantu, Mad dg – Madhava dravyaguna, Rv ni- Rajavallabha nighantu).

DISCUSSION

As per the Ayurveda concepts, excessive exercise causes the aggravation of *vata dosha*. This stage can be correlated with the transient immune depression phase followed by strenuous exercises. Further, it can be linked with the lactate formation stage of the anaerobic metabolism. Aggravated *vata dosha* may limit the performances of athletes. It causes emaciation, various kinds of pains, and fatigue related symptoms. *Ashwagandha* has a potent capability to pacify *vata dosha* (table 4). This helps in rapid recovery after strenuous exercises and competitions.

Pharmacodynamic properties of *Ashwagandha* (Ayurveda)³²

- *Rasa* (Taste) - *Tikta* (bitter) and *Kashaya* (astringent)
- *Guna* (properties) – *Laghu* (light), *Snigdha* (unctuous)
- *Veerya* (potency)- *Ushna*(hot)
- *Vipaka* (metabolic transformation)- *Madhura* (Sweet)
- *Prabhava* (special potency) - *rasayana* (rejuvenating) and *vrishya* (aphrodisiac)
- *Dosha Karma* (Actions)- *vata kapha shamaka*

The *laghu nature* (Lightness) of WS supports to reach the micro level of the tissues. *Snigdha* (unctuousness) pacifies the *rukshata* (rough) of *strotus* caused by exercises. It helps to maintain the body without being fatigue for a longtime. Once the *rukshata* occurs in the body, *vata dosha* also gets vitiated. *Vipaka* or metabolic transformation of WS is *Madhura*. *Madhura vipaka* nourishes the body. According to the *Indu bhashya* commentary on *Ashtanga sangraha*, *vipaka* gives the similar action of its related *rasas*³³. Hence, *Ashwagandha* gives *madhura rasa sadrusha karma* (similar actions of sweet taste) like, *tarpana* (nourishment), *murja prashamana* (alleviate fainting),

hrdya (good for heart), *trushna prashamana* (alleviate thirst), *daha prashamana* (pacify tiredness), *sarva dhatu vardhaka* (develop body tissues), *sthairyakara* (gives strength) , *balya*, and *brimhana*..etc³⁴. Meanwhile, *ushna* (hot potency) *veerya* helps to reach all the body parts due to its' *agneya* nature or mobility nature and it helps to pacify *vata* and *kapha doshas* as well. *Prakruta kapha dosha* is synonymous as *bala* and *ojas*³⁵. It increases immunity, and strength. *Ashwagandha* maintains the balance state of *kapha dosha* as well as *vata dosha* which are responsible for the functional and physical stability of the body. Consequently, *Ashwagandha* delivers *dhatu pushtikara* and *vardhaka* effects to the individual. Hence, this herb can replenish the immunity suppression caused by the exercises.

Correlation between Ayurveda *karma* and modern scientific facts

1. *Vata hara* action and *Kaphahara* action – increases aerobic exercise capacity & increases anaerobic exercise capacity, increases immunity
2. *Balya* – Cardio-pulmonary endurance, physical endurance, anti-anxiety effect
3. *Pushtiprada* – anabolic effect
4. *Vrishya* - aphrodisiac
5. *Rasayana* – adaptogen effect
6. *Shukrala* – immune-modulatory effect
7. *Jara-vyadhi nashana* –adaptogen effect
8. *Dhatu vriddhikara* – increase tissue masses, hemopoetic effect

CONCLUSION

WS has been tested by the researchers for its various effects of the body. In Ayurveda, it is been used in many diseases as a single drug and as a combined ingredient of medicines. Though Ayurveda had not mentioned a proper management for athletes, the herbs like WS can utilize by examining the *yukti*(rationale) and *artha* (purpose)³⁶.

Ergogenic aids are commonly used by the athletes to overcome their hurdles that occur in the competitive platform. There is a strong hunger for the safe supplements due to hazardous side effects of the modern steroid anabolic ergogenic aids. This study has

demonstrated significant scientific evidences of *Ashwagandha* on its' usage of sports medicine along with Ayurveda elucidation. It enhances skills by improving strength, endurance, and recovery of the athlete. Hence, WS can be performed as a perfect safe ergogenic aid.

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