EFFECT OF ASHWAGANDHA (WITHANIA SOMNIFERA) ROOT POWDER SUPPLEMENTATION ON THE $VO_{2\ MAX.}$ AND HEMOGLOBIN IN HOCKEY PLAYERS

[1]Dr. Arvind Malik [2]Vikas Mehta [3]Vishal Dahiya

[1]Associate Prof., Department of Physical Education, Kurukshetra University, Haryana
[2]Vikas Mehta, 2Assistant Professor, SGHS College, Sri Jiwan Nager, Sirsa, Haryana.
[3]Vishal Dahiya, Research Scholar, Dept. of Phy. Edu., Ch. Devi Lal University, Sirsa. Haryana

ABSTRACT

Withania Somnifera (WS) is used as adaptogen, antiarthritic, antispasmodic, anti-inflammatory, nervine tonic, nerve soothing, antioxidant, immunomodulator, free radical scavenger, anti-stress and anti-cancer agent. But ergogenic value of WS as nutritional supplement is yet to be established. Objectives: Present study was designed to investigate the effect of supplementation of WS on the VO_{2max} and Haemoglobin in Hockey Players. Method: Thirty two male hockey players, with a mean age of 17.4 ± 1.7 years and BMI 20.9 ± 2.9 kg/m2 volunteered for the study. Subjects were randomly assigned into two groups Group I (n=16): Withania somnifera group (experimental group) and Group II (n=16): Placebo (control) group. The experimental group received 500 mg capsules of aqueous roots of Ashwagandha twice daily for eight weeks, whereas the placebo group received starch capsules. Maximal oxygen consumption capacity in ml/kg/min (VO2max.) with Cooper (1968) 12 min. run test and hemoglobin (Hb) of both experimental and control groups were measured before and after the administration of Withania somnifera and placebo respectively. *Results: A significant improvement in the VO_{2max} ($t = 2.98$, $p < 0.01$) and hemoglobin ($t = 2.78$, $p < 0.01$) in experimental group was found. Whereas not any significant change in pre test and post test values of* VO_{2max} *and Hb was observed in the placebo group. Conclusion: Supplementation of Withania Somnifera improves VO_{2max} and hemoglobin concentration in young hockey players.*

Key Words: Withania Somnifera, Maximal Oxygen Consumption Capacity, Hemoglobin and Placebo

INTRODUCTION:

In Ayurveda, certain herbal formulas are considered to be rejuvenating. These formulas are called Rasáyana tonics Sharma PV (1999), and they are typically taken over long periods of time to regenerate both brain and body tissue. In rare cases an herb is so potent and has so many health benefits that Ayurveda considers it to be a Rasáyana therapy on its own, Ashwagandha is one such herb. It is considered as most important adaptogens in ayurvedic system of medicine. For centuries, Ayurvedic medicine has used the ashwagandha plant as an aphrodisiac, to remedy

general weakness and exhaustion, as well as for its stress-relieving qualities. With an abundance of antioxidants, iron, amino acids, and other phytochemicals, it's no surprise that studies suggest ashwagandha has medicinal properties that can directly and indirectly prevent and treat a number of diseases Agarwal R (1999).

Ashvagandha in Sanskrit means "smelling like a horse ", probably originating from the odor of its fresh root which resembles that of a sweaty horse. Ashvagandha is a well-known antistress herb. Ashwagandha is biologically known as Withania somnifera(WS). The species' name Somnifera means "sleep-bearing" in Latin, indicating that Ashvagandha was considered a sedative. However, it has also been used for sexual vitality and as an adaptogen. Ashvagandha is popularly known as Indian Ginseng because it is used to treat so many different conditions, just as ginseng is in Traditional Chinese Medicine. It is also known as Indian winter cherry - is a shrub cultivated in India and North America whose roots have been used for thousands of years by Ayurvedic practitioners. The root contains flavonoids and many active ingredients of the withanolide class Mishra at el. (2000).

Ashwagandha also appears to have antibacterial and antiviral properties of its own, even against multiple-drug resistant strains of these microbes Singh at el. (2011). Ashvagandha is an unique herb with antistress, adaptogenic action that leads to better physical fitness and helps with stress management Singh at el. (2010). It increases physiological endurance and protects against the effects of stress Armen and Sandhu (2007). It is especially beneficial in stress-related disorders such as arthritis, hypertension, diabetes and premature aging Mishra at el. (2000). It works in suppressing pains of any sort, this property due to its ushan virya potency, which helps in eradicating vata that is the reason of initiation of pain in body. Works as anti-inflammatory substance therefore helps in reducing swellings and restoring blood supply Anabalgan and Sadique (1981). Relieves stress due to presence of vata suppressant properties which helps in nurturing nervous system, provides nourishment to the brain for its better function and greater ability to work. Improves mental ability, helps in gaining retaining power and improves mental concentration. A powerful aphrodisiac thereby helps in enhancing the sexual powers, increasing sperm count and also the quality of sperms Ahmad at el. (2010). Behaves as diuretic therefore is very helpful in treating urinary tract infections (UTI) further useful in upper respiratory tract

infection (URTI) and in asthmatic condition. Withania somnifera have great antimicrobial potential against microorganisms Singh and Kumar (2011).

Aphale et al. (1998) reported in a study conducted on rats, intake of ginseng and ashwagandha for 90 days, researchers found significant increase in body weight, food consumption and liver weight, and improved hematopoiesis. They did not reveal any toxicity of brain, heart, lung, liver, spleen, kidneys, stomach, testis and ovaries. Further the side effects of WS were not significantly different from those experienced by placebo-treated individuals Cooley et al. (2009) and Chopra et al.(2004).Thus, ashwagandha probably is safe without serious side effects. There are only few scientific clinical studies showing effect of WS on selective parameter of exercise performance after regular administration when given as supplements. The present study was therefore designed and performed to assess the effects of Withania somnifera (Ashwagandha) on the VO2 max which refers to the maximum amount of oxygen that an individual can utilize during intense or maximal exercise and concentration of hemoglobin in humans.

METHODOLOGY:

The present randomized controlled, parallel group, single blinded study was conducted on thirty two male hockey players, with a mean age of 17.4 ± 1.7 (aged between 16 to 19 years) years and BMI 20.9 ± 2.9 kg/m^2 from Shri Guru Hari Singh Hockey Academy, Shri Jiven Nager, Sirsa, Haryana, who volunteered for the study. Subjects were randomly assigned into two groups using the chit in a box method, Group I (n=16): Withania somnifera group and Group II (n=16): Placebo (control) group. Withania somnifera was used in the form of a standardized aqueous root extract was obtained from Central Council for Research in Ayurveda and Siddha (CCRAS), Delhi, India. Prior to the start of data collection, participants were explained about the drugs and previous research supporting the effectiveness on physical performance and possible side effects due to overdose. Only then the subjects who volunteered to participate in the study were recruited. A written informed consent was taken from each participant and their parent prior to recruitment.

Quality and dose of drug was decided after consultation with the Ayurvedic Medical Officer of civil hospital, Sirsa. 500mg of roots of WS and 500mg of sugar power was filled in gelatin

capsules and stored in air tight containers and in room temperature below 30°C throughout the experiment. Drug and sugar capsules were given to their respective groups (Experimental and Controlled) in the dose of 1 capsule/day orally with milk after meals at night for 8 weeks under the personal supervision of researcher. Subjects were unaware of which group they were in and which drug they were to receive. It was thus a single blinded study, where all the subjects were completely unaware of drugs which they were going to consume. Maximal oxygen consumption capacity in ml/kg/min ($VO_{2max.}$ = (22.351 x kilometers) - 11.288 with Cooper (1968) 12 min. run test) and blood hemoglobin of both experimental and control groups were measured before and after the administration of Withania somnifera. The data was analyzed by student 't' test with Statistical Package for Social Sciences (SPSS - 20) software.

RESULTS:

The mean pre and post test VO_{2max} of control group was 48.16 ± 3.41 and 49.25 ± 3.12 respectively, the t value was 0.94 which is less than the table critical value which indicates that there is no significant difference in VO_{2max} of control group.

Table – 1

Comparative status of VO_{2max} in Placebo group (Control Group)

S.No.	Phase	Mean	S.D	Mean Difference	S.E.D	t – Value	P Value
1.	Pre Test	48.16	3.41	1.09	1.158	0.94	Not significant
2.	Post Test	49.25	3.12				

The mean pre and post test VO_{2max} of experimental group 48.23 ± 3.26 and 51.45 ± 2.86 respectively, the t value was 2.98 which is significant at 0.01 level of significance, this indicates that there a significant difference in the VO_{2max} level between the pre and post test in experimental group.

Table – 2

Comparative status of VO_{2max} in Withania Somnifera group (Experimental Group)

S.No.	Phase	Mean	S.D	Mean Difference	S.E.D	t – Value	P Value
1.	Pre Test	48.23	3.26	3.22	1.082	2.98	Significant at 0.01 level
2.	Post Test	51.45	2.86				

The hemoglobin status in the placebo group before and after the experiment was 13.24 ± 0.69 and 13.41 ± 0.72. The t value was 0.69 which was not significant at any level of significance; this indicates that there is no significant difference in the hemoglobin level in the placebo group before and after the experiment.

Table – 3

Comparative status of Hemoglobin in Placebo group (Control Group)

S.No.	Phase	Mean	S.D	Mean Difference	S.E.D	t – Value	P Value
1.	Pre Test	13.24	0.69	0.17	0.245	0.69	Not significant
2.	Post Test	13.41	0.72				

The hemoglobin level 13.21 ± 0.66 and 13.89 ± 0.70 was found in the experimental group before and after the experiment. The t value was 2.78 which is significant at 0.01 level of significance; indicates that there is significant difference in the hemoglobin level of the experimental group before and after the experiment.

Table – 4

Comparative status of Hemoglobin in Withania Somnifera group

(Experimental Group)

S.No.	Phase	Mean	S.D	Mean Difference	S.E.D	t – Value	P Value
1.	Pre Test	13.21	0.66	0.68	0.245	2.78	Significant at 0.01 level
2.	Post Test	13.89	0.70				

DISCUSSION:

Results indicate a significant ($P< 0.05$) improvement in the VO_2max. and level of blood hemoglobin in the Withania Somnifera group(experimental group). Athletes expend a remarkable amount of energy and challenge the recovery processes of their bodies. The treatment with W. somnifera effectively reduced oxidative stress, as assessed by decreased levels of

various oxidants and improved level of diverse antioxidants Ahmad at el. (2010). VO_2 max represents long term aerobic and cardiovascular endurance in the athletes. Endurance training, combined with a favorable genetic disposition, results in a series of physiological adaptations, designed to maximize endurance performance by increasing the amount of oxygen, which can be delivered to and utilized by working muscles._ Athletes expend a remarkable amount of energy and challenge the recovery processes of their bodies. After the eight-week supplementation with *Ashwagandha*, the hockey players showed a statistically significant improvement from 48.23 mL/kg/min to 51.45 m/ kg/ min table -2.

Long term strenuous exercises release of free radicals that causes oxidative damages of varied amount on different systems of human body. Stress can cause increased peroxidation of lipids, while decreasing levels of the antioxidant enzymes catalase and glutathione peroxidase. When ashwagandha extract was administered by re-searchers one hour before a daily stress-inducing procedure, all of the aforementioned parameters of free radical damage normalized in a dose-dependent manner Bhattacharya at el. (2001). Researchers from Banaras Hindu University in Varanasi, India, have discovered that some of the chemicals found in Withania somnifera are powerful antioxidants. Since traditional Ayurvedic use of WS has included many diseases associated with free radical oxidative damage, it has been considered likely the effects may be due to a certain degree of antioxidant activity. The active principles of WS, sitoindosides VII-X and withaferin A (glycowithanolides), have been tested for antioxidant activity using the major free-radical scavenging enzymes, superoxide dismutase (SOD), catalase (CAT), and glutathione peroxidase (GPX) levels in the rat brain frontal cortex and striatum. Decreased activity of these enzymes leads to accumulation of toxic oxidative free radicals and resulting degenerative effects. An increase in these enzymes would represent increased antioxidant activity and a protective effect on neuronal tissue Studies conducted on rats' brains showed the herb produced an increase in the levels of three natural antioxidants- superoxide dismutase, catalase and glutathione peroxidase Dhuley JN (2007).

Ashwagandha contains flavonoids and many active ingredients of the withanolide class Singh at el.(2010). A study done at the Department of Pharmacology, University of Texas Health Science Center indicated that extracts of Ashwagandha produce GABA (Gamma Amino-butyric acid)

which is an inhibitory (calming) neurotransmitter in the brain. There is evidence that getting extra GABA into the brain increases Human Growth Hormone Passariello at el. (1982). Its function is to decrease neuron activity and inhibit nerve cells from over firing. Too much neuronal activity can lead to restlessness and insomnia, but GABA inhibits the number of nerve cells that fire in the brain, and helps to induce sleep, uplift mood, and reduce anxiety all these factors are very much help full in recovery from strenuous exercise.

The growth-promoting effect of WS was studied for 60 days in a double-blind study of 60 healthy children, age 8-12 years, experienced a slight increase in hemoglobin, packed cell volume, mean corpuscular volume, serum iron, body weight, and hand grip, and significant increases in mean corpuscular hemoglobin and total proteins ($p<0.01$) at the end of 60 days when compared to the initial level and the placebo group Venkataraghavan at el.(1980). WS may induce the synthesis of inducible nitric oxide expression likely by acting at transcriptional level Iuvone at el.(2003). Nitric oxide production plays a role in maintaining cardiovascular health. Here's how: Inside your body nitric oxide is produced by endothelial cells that line your blood vessels, and acts as a messenger molecule by telling the blood vessels when to relax and expand. When adequate nitric oxide is produced, it causes an "endothelial relaxing factor," which is needed by the arterial system to expand and contract with each heartbeat. This helps regulate blood flow and pressure, so that oxygen-carrying blood is delivered to your tissues and organs leads to improvement in the aerobic capacity.

Ashwagandha improved the cardiorespiratory endurance of the elite athletes Shewta at el. (2012). Though there are many factors that could contribute to the increase in the maximal oxygen consumption, we believe that an increase in the count of RBCs and Hb could have played a role; a study by Ziauddin et al.(1996) reported that Ashwagandha increased both the RBC and Hb count. The increase in RBC mass leads to an increase in the capacity of the blood to transport oxygen directly to the exercising muscles, thereby enhancing the aerobic capacity directly, enhancing the aerobic capacity. Further studies on VO_{2max} and Hb count would provide conclusive evidence regarding the mechanism of the ergogenic effect of Ashwagandha.

CONCLUSION:

Withania somnifera may therefore be useful for to improve VO_2 max. and level of blood hemoglobin. Drug appears to be safe for young adults when given for mentioned dosage and duration. The current study was limited to an 8 week period on young adults playing hockey. The forthcoming researches should focus on dose finding, longer treatment duration as well as gender specific effects of WS. Further studies are also required to measure whether the drugs can improve other parameters of physical fitness so that in future Withania somnifera can be used as ergogenic elements.

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