WITHANIA SOMNIFERA AS AN ADAPTOGEN AND SPORTS PERSEVERANCE

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Abstract:

Adaptogens are biologically active substances of plant origin that cause non-specific increase in the body's resistance to various environmental stressors that can disrupt internal homeostasis, although they can also improve physical endurance. Adaptogens support optimal energy and improve endurance and the ability to perform demanding activities. They can affect the increased resistance to stress as well as faster regeneration. Supplementation of herbs with adaptagenic properties can favorably affect the general physical and mental health and promote the proper, healthy functioning of the body. Knowledge of the mechanisms of the body's response to stress allows us for better understand the multidirectional biological activity of adaptogens, which strengthens the body's ability to counteract many forms of stress and maintain natural balance-homeostasis. It is believed that in supporting the positive adaptive response of the body to stress, the key role is played by their regulatory influence on the interaction of the neuroendocrine system and the immune system, particularly through the action on the hypothalamus and regulation of stress hormones, mainly cortisol. One of such adaptogenic plants is Withania Semnifora, a herb that has been used for a long time in Arjuvian medicine. And it shows the number of properties that can help in achieving successes in sport.

Nowadays there are not enough studies on population especially on athletes and adaptogens supplementation, so there is opened new way for possibly future researches, who will be able to analyze the real possibilities to improve the physical and mental sport performance in different sport disciplines.

INTRODUCTION

Nowadays, we are exposed to many stressful factors that can cause numerous imbalances in our body. Such stress occurs both from the physical side (hard work, physical effort, workouts) but also from the psychological side. Some of us may be more resistant, others unfortunately are not and then there may occur health problems, which may affect not only the appearance of our figure and training instruction, but above all the normal functioning and the need for treatment. The maintenance of homeostasis in stages of internal or external challenges, called stressors, requires constant adjustments of hormonal, behavioral, and autonomic functions [Miller 2002]. Stressors are external stimuli, chemicals, environmental factors, or biological agents that cause stress to an individual by triggering the hypothalamic-pituitary-adrenal (HPA) axis stress response [Sato et al. 2006]. After prolonged exposure to stressors, our body needs adaptive mechanisms that, through morphological, biochemical and physiological changes, are able to bring homeostasis. These mechanisms

occur at all levels of the organism organization, both at the cellular level and at the level of organ regulation. The adaptive reactions of our body work according to a permanent model, regardless of the type of stressor [Mrozowski 2007]. There are three phases of general adaptative syndrome (GAS), according to Selye [Selye 1976]. The first is the initial stress recognition - alarm reaction (during which resources are mobilized to fight danger. In its initial phase a decrease in body temperature and blood pressure is observed, after which it comes to the phase of counteracting the shock). The second stage involves the acquisition of nonspecific resistance (all resources of the unit to fight the threat). Stage three exhaustion (when the same symptoms reappear, followed by mental and physical illness or death).

Stress is a phenomenon also present in sport, especially in the context of sports competitions. The athlete, who is often very good at training, during the important sporting event achieves much worse results, which is not related to the reduced motivation of the players, but rather the lack of skills to deal with pre-start stress. Such emotions as anxiety strongly affect our body. Accelerated heart rhythm, hand tremors, fast and shallow breathing are some of the most common symptoms of stress. These direct, physiological reactions can significantly affect the start of the competition and sports results achieved by athletes. Already in the 1950s and 1960s, Russian scientists suggested that same herbal extracts could prolong resistance to stress and diminish the magnitude of the alarm phase. Term adaptogens have been defined as non-toxic substances with a multimodal mechanism of action that result in better adaptation and survival [Brekhman et al. 1968].

Adaptogens

Adaptogens are active, substances of plant origin, which facilitate the adaptation of the system to adverse environmental conditions. For the first time, the term was used by the Russian scientist Lazarev in 1947. Adaptogens originally defined as substances “that increase resistance to broad spectrum of stressors of different physical, chemical, and biological natures,” [Wagner et al. 1994; Panossian et al. 1999]. Adaptogens are considered “metabolic regulators, which increase the ability of system to adapt to environmental factors and to avoid injuries from such factors.” [Panossian et al. 1999]. Some adaptogenic plants have been used in traditional Chinese medicine and Ayurveda for centuries to promote physical and mental health, improve the body’s defense mechanisms, and enhance longevity. However, further evidence, based on well-designed clinical trials with standardized herbal preparations, is required to support the efficacy of these traditional herbal medicines to qualify them as herbal medicinal products with well-established use in medicine [Panossian 2017].

The mechanism of action of adaptogens is not completely understood. However, it is known that morphological, biochemical and physiological changes are at the basis of activity on the human body. They occur at the cellular level through interacting enzymatic systems as well as at the organ level through hormones. It seems that in the case of adaptogens, the theory of one receptor involved in the pharmacology of adaptagen activity is insufficient. Adaptagens have effects on many different receptors (including receptors for mineral corticoids, corticosteroids, serotonin, estrogen, NMDA, nicotine, acetylcholine and G-protein-coulped receptors [Pearce 2012; Huo et al. 1988; Leung, Wang 2010, Lee et al. 1997; Nah 2012; Hahm et al. 2011; Ravindran et al. 2015, Khazal et al. 2014]

The pharmacologic efficacy of adaptogens and their stress-protective effects are usually investigated by testing cognitive function and physical endurance under stressful conditions [Panossian et al. 2005]. Adaptogens are able to regulate homeostasis through several mechanisms related to the hypothalamic-pituitary-adrenal (HPA) axis and the control

of stress-response mediators, such as the molecular chaperone (Hsp70), c-Junna-activated N-terminal protein kinase (JNK1), DAF -16 Forkhead Box transcription factor, cortisol and nitrous oxide (NO). It seems that adaptogens are regulate the Hsp70 protein, which plays an important role in cell survival and apoptosis. Hsp70 inhibits the expression of the NO II syntheses gene and interacts with glucocorticoid receptors directly and via the JNK pathway, thus affecting circulating cortisol and NO levels. Prevention of stress-induced NO increase and associated decrease in ATP production results in increased productivity and durability. Adaptive Hsp70 triggers stress-regulated stress-regulating pathways that lead to improved mental and physical performance, and probably longer life [Panossian 2003; Panossian et al. 2009, Panossian et al. 2010, Panossian et al. 2012]. Systematically used, they not only improve the overall condition and endurance of the body, but also improve the regeneration of the body and allow to regain much more quickly after the disease. All of these effects are based on the guiding principle of adaptogens - restoring balance. It allows you to keep health, fitness and well-being.

There are many plants that are adaptogens [Wagner et al. 1994, Panossian 2017]. Many plant varieties of adaptogens have been studied to improve physical performance, but only some of them exhibited regeneration properties after intense efforts and fatigue effects [Morihara et al. 2007]. Some adaptogens showed a positive effect on the improvement of physical activity in scientific research, but in this short review I focus on the plant used for a long time in Ayurvedic medicine - Withania Somnifera.

Withania Somnifera – as adaptogen

Withania Somnifera plant belonging to Solanaceae family, it is a small shrub up to 0,5-2 m high. Also called "Indian Ginseng", winter cherry or Ashwagandha. It occurs in the Middle East, Sri Lanka, India and China. It is also found in Morocco, Pakistan, Egypt, Palestine, Jordan, South Africa, Afghanistan and Australia [Purdie et al. 1982, Sangwan et al. 2004]. For centuries, Withania Somnifera has been used in Ayurvedic medicine [Thakur et al. 1987].

Withania Somnifera increases energy, strength, influences the parameters of blood and lymph, adipose tissue and cell production. In addition, it can be used to increase and improve general health and prevent diseases in athletes and the elderly [Mishra et al. 2000]. As it is shown in the past studies, Withania Somifera can be widely used in a number of human-related diseases, including antineoplastic, antimicrobial, anticonvulsant, antioxidant, anti-neurodegenerative and immunomodulatory factor. It is assigned number of pharmacologic properties such as anti-stress, stimulant, anti-inflammatory, anti-depressant and many others [Kulkarni et al. 2008; Gokul et al. 2012; Sood et al. 2015, Wadhwa et al. 2016, Mishra et al. 2000]. The highest therapeutic properties are attributed to the substances contained in the root, however, both flowers and fruits are not devoid of valuable chemical constituents. Phytochemical studies show that there are nearly 50 different active substances in the plant that may affect our body. Adaptogenic effect of the plant, may result from the complex of the steroidal withanolides found in the root of the herb [Mirjalili et al. 2009].

There are many studies showing the beneficial effects of substances contained in Withania somnifera on the increase in activity or anti-stress in animal models [Mistra et al., 2009, Gupta et al., 2007, Shah et al., 2006]. Mystra and colleagues have shown that Withania Somnifera root extract reduces the oxidative damage induced by physical effort in the rat's forced swimming test. In addition, in the same test of forced swimming in rats, the Shah group showed that Withania Somnifera has antidepressant effects. Gupta in his research showed the effect of Withania Somnifer on anxiety and depressive behavior induced by social isolation in rats. The positive effect of Withani Somnifera root extract on depression behaviors has been demonstrated. This seems to be an interesting issue in the context of stress

experienced during sports competitions. What's more, in the mouse model of Chronic Fatique Syndrome (CFS), it was shown that treatment with strong antioxidants resulted in a significant reduction of immobility. Similar effect was observed in the herbal extract Withania Somnifera, quercetin and St. John's wort. Thus, these findings strongly suggest that oxidative stress may play a role in the pathomechanism of CFS and antioxidants. Withania can also be useful in therapy [Singh et al. 2002]. Most studies on Withania Somnifera used animal experiment models, but also in human clinical trials, the anti-anxiety efficacy of ethanol herb extract was evaluated [Andrade et al. 2002]. In this study, 20 patients suffering from anxiety disorders received Withania Somnifera extract, and 19 people received a placebo. This study showed tendency for Withania anxiolytic properties over placebo, and the authors suggest that Withania has a useful anxiolytic potential. Moreover, in the clinical study Patients with a history of chronic stress were enrolled in the study, in which they were given 300 mg of a high-concentrated extract with full spectrum of action from the root of Withania Somnifera and a placebo in the control group for 60 days. The patients were then measured cortisol level and like authors suggests the serum cortisol levels were substantially reduced in the Withania group, relative to the placebo group. The conclusion of the authors was that the highly concentrated extract of Withania Somnifera root effectively improves the resistance of the individual for stress, and thus improves the self-esteem in quality of life [Chandrasekhar et al. 2012]. Sandhu's study was designed to assess the effect of Withania somnifera and another adaptogen Terminalia arjuna individually and as a combination to achieve maximum velocity, mean absolute and relative strength, balance, maximum oxygen consumption (VO2 max) and blood pressure in humans. These study showed that Withania Somnifera increased velocity, power and VO2 max and authors concluded that Withania somnifera may be useful for generalized weakness and to improve speed and lower limb muscular strength and neuro-muscular co-ordination and it seems to be safe for young adults when given for mentioned dosage and duration [Sandhu et al. 2010]. For athletes and active people Withania Somifera can therefore be the perfect complement to a balanced daily diet. Perhaps the trainings will be more effective (longer, stronger, faster etc.), because the body is able to regenerate more quickly and more easily withstand heavy loads. This action has already been confirmed by many studies on endurance and strength sports.

Conclusion

Nowadays, we attach more and more importance to what we eat. It is especially important in the context of athletes, who care about meal compositions and adequate supplementation. Hence the growing interest in natural substances to avoid the risks with syntetic drugs. What is more, the stress constantly present in our lives causes the disturbance of homeostasis and more and more problems with health. Perhaps adaptogenic plants will be able to naturalize these effects. However, at the moment new research is still needed to show and explain the mechanisms of action and the possible side effects.

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