



ADAPTO-ZEST

Scientific Research

Stress is a state of real or perceived threat to physiological homeostasis. A living organism maintains an intricate homeostasis which is perpetually challenged by internal and external stressors. Stress can be defined by experiences, or exposure to agents, which are emotionally or physiologically challenging. Stress factors can be categorized into various types like environmental, metabolic, pathogenic, emotional, mental and physical stress.

Environmental stress: pollution, energy, radiation and extreme temperatures.

Chemical stress: alcohol, caffeine, drugs, nicotine, toxins, pesticides, pharmaceuticals.

Metabolic stress: physiological stress induced by our daily metabolic processes related to our lifestyle.

Pathogenic stress: physiological challenges in response to pathogenic invasion by viruses, bacteria, parasites and fungi.

Emotional stress: death, illness, work stress, social stress, relocation, divorce, relationships and financial stress.

Mental stress: cognitive challenges faced in a work environment or at school or university.

Physical stress: intensive physical challenges like rigorous exercise training or intensive long term physical work, illness, pregnancy and premenstrual syndrome.

The body responds to stress by a complex sequence of physiological and behavioural processes in order to reestablish equilibrium. Acute stress stimulates the release of stress hormones or mediators like adrenaline, noradrenaline and cortisol from the adrenal glands. These mediators generate an increased heart rate and blood pressure, increase fat breakdown and elevate blood glucose. Subsequently, increased fuel and oxygen supply is provided to the brain and muscles for the 'fight or flight' response of survival to the perceived threat. The release of stress hormones in reaction to acute stress, functions to protect the body and promote adaptation. Adversely however, acute intensive stress may also trigger allergic reactions like asthma, eczema, urticaria, migraines, hypertensive or hypotensive attacks,

pains and spasms, gastrointestinal symptoms, panic attacks and psychotic episodes, depending on the health state of an individual. Long term chronic stress lead to constantly high blood cortisol and other stress hormone levels which may eventually cause systemic inflammation and

degeneration. Target systems influenced by these stress hormones or mediators include the reproductive system, thyroid hormone axis, metabolic system, immune system, growth- and cognitive system. Improper regulation of the stress response in the long term can trigger various disease states like autoimmune disease, hypertension, sleep disorders, chronic fatigue, mood disorders like anxiety and depression, metabolic disorders like obesity and diabetes, neurovascular degenerative disorders, cognitive decline and memory loss, low bone density and osteoporosis (1).

PSNLifestyle Adapto-Zest comprises an advanced selection of powerful adaptogenic plant extracts including **Ashwagandha, Cordyceps, Rhodiola, Schisandra, Bio-Curcumin/BCM-95®** and **L-theanine** combined with **Vitamin B12**. The protective effect of adaptogens are related to their role in regulating homeostasis of the hormonal hypothalamic-pituitary-adrenal axis (HPA) and central nervous system activity, which governs our stress response systems. These bio-active adaptogens are supported by various research studies for their ability to modulate physical and psychological response to physical, chemical, biological and psychological stress and for their protective and regenerative role against damage caused by such stress factors.

Ashwagandha (*Withania somnifera*) is considered as a physical and mental tonic and aphrodisiac. It is a multipurpose herb which functions to balance various physiological systems like the neurological system, hormonal system, reproductive system and energy metabolism. Ashwagandha is well researched for its cognition-enhancing, anti-depression-, nerve-regeneration-, stem cell synthesis-, adaptogenic- and immune-modulating functions. It is also indicated for improved mental performance, inflammation, osteoarthritis, bacterial and fungal infections, cardiovascular health, blood sugar control, hormonal imbalances and organ health (2).

Ashwagandha is a powerful anti-stress phytomedicine by means of its regulating effect on increased cortisol levels, which are triggered by stress (3). It also has a very significant benefit on neurotransmitter activity and hereby supports emotional and cognitive wellbeing. By activating and enhancing the efficiency of GABA- and serotonergic receptors, it exerts anxiolytic and anti-depressive effects, whilst also promoting better quality sleep (4,5,6). GABA is the central inhibiting neurotransmitter which functions to induce a state of relaxation, whilst serotonin is our main mood regulator which is also involved in regulation of sleep, memory and learning, behaviour, appetite, body weight, body temperature, cardiovascular functions, muscle contraction, hormonal homeostasis and digestive function.

Ashwagandha's cognition enhancing benefits are mainly associated with an increased availability of acetylcholine which is the main neurotransmitter involved in memory and learning. Subsequently, it has great clinical potential to be used in the treatment of Alzheimer's and Parkinson's disease, dementia and memory deficits caused by head injury, prolonged illness or old age (7).

Ashwagandha also displays significant hormone balancing properties and except for its well-known aphrodisiac powers, it demonstrates promising results regarding infertility treatment. Research reports an increase in semen quality, reproductive hormones and also testosterone levels in men, with one study indicating an increase of up to 140% of baseline testosterone

values, following six months of Ashwagandha supplementation (8).

Ashwagandha can also improve physical or athletic performance in inactive people as well as athletes. It demonstrates a significant increase in strength following supplementation, with or without exercise training (9,10) whilst in aerobic exercise, it is reported to significantly increase VO₂max and time to fatigue on the VO₂max test (11).

Cordyceps (*Cordyceps sinensis*) is one of the finest medicinal mushrooms with high nutrient value and has been used for thousands of years for an array of ailments. Cordyceps enhances healthy vigour by promoting cellular energy production. Cordyceps' powerful pharmacological potential comprises aphrodisiac, immunomodulatory, anti-inflammatory, antioxidant, antidiabetic, anti-aging, anti-pathogenic, fertility enhancing, liver-, kidney and cardiovascular health promoting functions (12,13). It has been used for centuries for the treatment of cancer, TB and other respiratory diseases, diabetes, erectile dysfunction, jaundice, alcoholic liver disease, kidney disease, infertility, night sweats and many more (14).

With a continuing increase in life's challenges and responsibilities we are constantly exposed to stressors which may eventually lead to chronic fatigue if not managed correctly. Physical and mental fatigue is a common phenomenon in illness and health. It is induced by triggers like environmental challenges, disease, poor lifestyle, poor dietary habits, inactivity or excessive physical activity, certain medications as well as emotional and mental stress. Fatigue may be characterised by muscle weakness and decreased endurance, slowed motor skill performance and mental and emotional exhaustion.

In combination with the other adaptogens in PSNLifestyle Adapto-Zest, Cordyceps with its potent adaptogenic properties, speeds recovery time and restores health and vitality after illness or exhaustion (16). Cordyceps has very powerful anti-fatigue properties. It inhibits fatigue related inflammatory dysfunction in the immune tissues or organs. It prevents fatigue related alteration in expression of genes that are involved in muscle damage, regeneration and repair (15).

Cordyceps improves efficiency of cellular oxygen utilization and mitochondrial energy production. It also improves liver energy metabolism, enhances blood circulation, provides anti-oxidant protection and functional improvement of the respiratory and cardiovascular systems (14).

Research illustrates that Cordyceps also has significant antidepressant properties by regulating noradrenalin and dopamine neurotransmitter systems. Its mechanisms of action may involve its binding to adrenal and dopamine receptors and inhibiting reuptake of dopamine and noradrenalin. Subsequently, healthy circulating levels of these neurotransmitters is sustained (17). Neurotransmitter dopamine, is mainly implicated in motivation, pleasure and reward. Dopamine plays a vital role in neurocognitive functions including memory, organizing and attention, whilst neurotransmitter noradrenaline is implicated in alertness, attentiveness, concentration and cognitive ability (18).

Bio-Curcumin (*Curcuma longa*)/BCM-95® extract has a seven times greater bioavailability than ordinary 95% extract and 400mg is equivalent to 2772mg of the standard 95% curcumin extract. Curcumin exerts very powerful immune-modulatory, anti-inflammatory and anti-oxidant functions and protects cardiovascular, liver, kidney and digestive system health (19). It also has a substantially beneficial effect on emotional and mental wellbeing by modulating neurotransmitter levels in the brain like norepinephrine, dopamine and serotonin (20,21). Curcumin further demonstrates neuroprotective effects in multiple neurodegenerative and psychiatric disorders like Alzheimer's disease, Parkinson's disease, depression, epilepsy, stroke, schizophrenia, drug addiction, toxin and alcohol induced neurotoxicity, and tardive dyskinesia (19). Its powerful neuro-regenerative role can be attributed to its anti-inflammatory, anti-oxidant, anti-protein-aggregate properties and its ability to increase the level of brain-derived neurotrophic factor (BDNF). BDNF attributes to growth and maturation of nerve cells and promotes their survival (30).

Rhodiola (*Rhodiola rosea*) is one of the most well-known adaptogens and upholds generalized resistance against damaging chemical, physical,

psychological and biological challenges. Its adaptogenic benefits can mostly be ascribed to its ability to regulate levels and activity of circulating neurotransmitters including dopamine, serotonin, noradrenaline, adrenaline, as well as opioid peptides like beta-endorphins, which act as neuromodulators. Other mechanisms related its interaction with the hormonal HPA system, include regulation of cortisol levels, nitric oxide, protein kinases p-JNK and defense mechanism proteins (22). Rhodiola subsequently plays a significantly positive role in depression and anxiety. It also has a stimulant effect on neurocognitive function, enhancing attention, memory and learning. Other proven qualities of Rhodiola include the ability to provide antioxidant protection, enhance physical exercise and endurance capacity, to promote healthy energy levels and longevity, support organ and cardiovascular function as well as blood glucose homeostasis (23). Rhodiola is supported by multiple research studies for its great potential in benefiting many conditions like sexual dysfunction, menstrual irregularities, cancer, colds and flu's, depression, schizophrenia, fatigue, headaches, hypertension, sleeplessness, dental disease and cardiovascular disease (24). As mentioned above, Rhodiola has significant ergogenic or physical performance enhancing properties. It's contributions to physical vigour and athletic performance, include enhanced glucose uptake as muscle and brain fuel, increased anti-oxidant and anti-inflammatory protection against muscle damage, higher lactate clearance during recovery, increased VO₂ max, more proficient cardiovascular function and reduced neural sensation of fatigue. Consequently, Rhodiola can improve time to exhaustion or endurance capacity and athletic performance time (25).

Schisandra (*Schisandra chinensis*) is an invigorating phyto-active, with a medicinal history of more than 2000 years. Schisandra is acknowledged for its great potential as ergogenic aid and is successfully used by athletes to improve their endurance capacity and performance. It functions by increasing blood circulation and perfusion to the muscles by increasing nitric oxide (NO) levels which activates blood vessel dilation. Consequently, the muscles are provided with improved availability of nutrients and oxygen as well as improved

clearance of metabolic wastes for more efficient recovery. When the intensity of physical exercise exceeds the capacity of the aerobic system (low to moderate intensity activity, relying on oxygen) the muscles start functioning anaerobically (high intensity activity, insufficient availability of oxygen) and uses phosphocreatine, glycogen and glucose as essential fuel. During this process of glycolysis, when limited amounts of oxygen is available, glucose is metabolised to produce cellular energy and blood lactate is produced as byproduct. Blood lactate concentration can be used as an indicator of exercise intensity and measure of fatigue. The higher the intensity, the more energy is required and the more lactate is produced. Another biochemical indicator of exercise intensity is blood urea nitrogen (BUN) which is produced during the breakdown of protein and amino acids, fatigue, stress and dehydration. Schisandra's anti-fatigue role is illustrated by a significantly decreased lactate concentration and decreased blood urea nitrogen (BUN) levels following strenuous anaerobic exercise. Schisandra can therefore effectively enhance endurance capacity, performance time and muscle recovery (26).

As an adaptogen, Schisandra also counteracts the deleterious effects of stress by providing anti-oxidant and anti-inflammatory protection (27), regulating stress hormones, preserving the adrenal cortex and protecting the integrity and function of the central nervous system (28). Subsequently, Schisandra promotes healthy energy levels, reduces fatigue, improves memory and learning, and as a sedative, alleviates stress and anxiety. Schisandra has been used for centuries as a stress reliever. It decreases perceived intensity of stress by reducing cortisol levels and also protects against stress induced liver damage. Whilst counteracting the damaging effects of stress, it also supports healthy cognition including memory and focus by stimulating blood flow to the brain, neurotransmission of neurotransmitters and by increasing circulating acetylcholine levels, which is essential for learning and memory (29). Complementing the other adaptogens in this formulation, Schisandra also exerts a significantly protective effect on the immune system, cardiovascular and circulatory system, as well as the kidneys, lungs and liver (27).

L-Theanine, an amino acid extract of Green Tea, protects the nervous system against damage caused by neurotoxins and trauma. It enhances memory and attention and exerts a calming and uplifting effect by stimulating alpha brain waves and regulating neurotransmitters including dopamine, serotonin and GABA (31,32,34). L-theanine also regulates abnormal levels of adrenal stress hormones like cortisol and stimulates the expression of nerve growth factor (NGF) mRNA in the brain (34). NGF is a protein involved in nerve cell growth, integrity and survival. In an 8-week study involving schizophrenic patients, L-theanine was added to standard antipsychotic therapy. The combination of L-theanine with the antipsychotic medicine has been found to significantly reduce anxiety and improve several other measures of mood compared to pharmaceuticals alone (33). L-theanine has significant anti-fatigue properties and can be beneficially applied as an ergogenic aid. It has been reported to alleviate physical fatigue by increasing circulating dopamine levels (improved motivation and drive) and liver glycogen (as fuel), whilst also decreasing blood urea, lactate and 5HT (serotonin). The concentration of 5HT, like blood urea and lactate, is used as an indicator of physical fatigue with higher 5HT concentrations being associated with increased sense of exhaustion. Subsequently, L-theanine can increase time to fatigue and thus enhance performance. L-theanine also provides protection to the cardiovascular system, decreases hypertension, protects the liver, improves immunity and exerts anti-diabetic and antitumour actions (34).

Vitamin B12 (Methylcobalamin) is critical for various functions in the body, including DNA synthesis, formation of the nerve cell sheath and nervous system function, as well as for synthesis of rapidly dividing tissues like the gastric lining and blood cells. Vitamin B12 as supplement, exists in two main forms, with one being Methylcobalamin and the other, cyanocobalamin. Cyanocobalamin is the most common form of Vitamin B supplementation. It is chemically synthesized and only 1% of it is converted into active methylcobalamin in the body (35). Methylcobalamin is an active form of Vitamin B12 and with its methyl group, has been found effective in the treatment of autism and cognitive decline (36,37). It does not require intrinsic

factor for absorption and thus has a higher bioavailability than cyanocobalamin and longer tissue retention (38,39). Vitamin B12 deficiency or anemia is common (up to 62% at the age of 65) and can lead to neurological and psychiatric disorders. Deficiency is related to a vegetarian diet, excessive alcohol intake, aging, pregnancy, hemolytic anemia, blood loss, gastrointestinal inflammation, cancer, Alzheimer's disease,

certain medications and liver or kidney disease (40). Supplementation, in case of deficiency can benefit various physiological imbalances like depression (43), impaired mental health (37), the risk of stroke (42), cardiovascular health (36), diabetic neuropathy (44), heart rate irregularity (45), male impotence (46), sleep disturbance (47) and immunity (41).

Support a healthy body and mind and adapt to life with **PSNLifestyle Adapto-Zest** for a more relaxed state of mind, enhanced longevity and vigour.

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