

Ecdysterone-Rich Botanicals that Promote Anabolic Metabolism and Metabolic Homeostasis

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Discussion

METABOLIC HOMEOSTASIS

It is vitally important to maintain metabolic balance for our health, athletic endeavors, healthy aging and to enhance recovery from illness. In today's world, our bodies are continually challenged with overwhelming stress factors from internal and external sources. These challenges, along with the natural aging process, can contribute to dysfunctional metabolic pathways.

Metabolism is an ongoing dynamic biochemical process at the cellular level that sustains life through continual transformation of nutrients and molecular compounds. In this process, energy is both consumed and produced and heat is released, which maintains our warm body temperature.

Metabolism consists of the anabolic (building up) and catabolic (breaking down) phases. Anabolic processes consume energy to build complex molecules from simpler ones. Enzymes and coenzymes mediate all metabolic processes that transform nutrients into building blocks for the cells and tissues of our body. In catabolic processes, complex compounds are broken down into simpler molecules, producing biochemical energy. About one-fourth of this energy is utilized by cells and the remainder is released as heat, which maintains body temperature. Metabolic rate is measured in terms of the amount of heat released during metabolic processes.

Together, the ongoing dynamic balance of anabolic and catabolic processes creates metabolic homeostasis. While these processes occur continuously, anabolic processes are favored during times of rest, healing, pregnancy, lactation and growth. Basal metabolic rate (BMR) refers to the lowest rate of energy expended to maintain basic physiological functions such as respiration and circulation. Metabolic rate increases after a meal, with exercise and from other factors. Catabolic processes can become predominant in conditions of disease, stress, hormonal imbalance, fever or starvation. Excessive catabolism can lead to tissue wasting, cellular injury or even death.

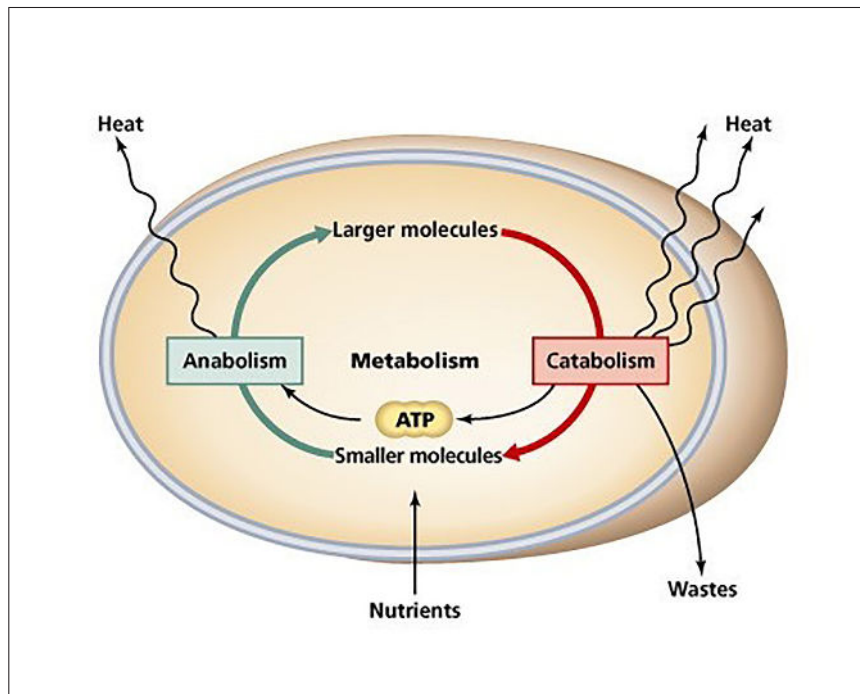
The natural process of aging reflects a change in the anabolic/catabolic balance to a more catabolic state. Recovery and healing time takes longer and metabolism often slows. Aging, chronic stress and disease can cause the body to enter an over-catabolic state. This results in negative effects including muscle loss, reduced cellular and systemic energy, poor physical and mental performance, lowered immune response and resistance to disease, hormonal imbalance, poor or prolonged recovery from illness or injury and accelerated aging.

Insufficient sleep can trigger decreased anabolic processes, which usually predominate during times of rest. Chronic stress leads to changes in cellular dynamics including increased oxidative stress, inflammation and cell-signaling. A disruption in cellular redox homeostasis impacts metabolic processes and health.

SARCOPENIA AND CACHEXIA

The term catabolic wasting includes both sarcopenia and cachexia. Though defined as two distinct syndromes, they are recognized as being overlapping conditions. Both are characterized by inflammatory processes and decreased muscle mass. Muscle tissue is metabolically very active and highly vascular. In both sarcopenia and cachexia muscle function is affected with loss of strength or physical performance.¹⁻³

Sarcopenia, considered an age-related condition with decrease in lean muscle mass, can have far-reaching effects on quality of life and ability to function. There is a decline in both muscle turnover and repair capacity. Measured by oxygen consumption, it is estimated that endurance capacity declines about 10% per decade. There are also changes in enzymes involved with energy production – while anaerobic enzymes remain constant, aerobic energy production enzymes seem to decrease with age¹



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Sarcopenia is a significant area of interest because of its prevalence. In 2000, the estimated direct cost of sarcopenia in the United States was \$18.5 billion; close to that of fractures due to osteoporosis.¹ Factors that contribute to sarcopenia include insulin resistance, decreased BMR and increase in body fat mass. There is often decreased physical activity, chronic inflammation, nutritional deficiency and lower excretion of hormones.¹

Cachexia is considered a complex metabolic disorder caused by inflammatory processes and underlying illness. Weight loss occurs with loss of muscle mass while fat mass may or may not be affected. Cachexia does not respond to normal nutritional support.¹⁻³ Other contributory factors to cachexia include increase in muscle protein synthesis and degradation, increase in BMR and energy expenditure and insulin resistance.¹

ADAPTOGENS ENHANCE METABOLIC HOMEOSTASIS

Adaptogenic herbs are foundational to promote metabolic homeostasis through enhancing anabolic balance. Supporting anabolic metabolism is vital to healing and repair, healthy aging and sustained energy for daily life. The anabolic process of metabolism ensures a healthy storage and reserve of nutrients for use by cells and tissues. Anabolic activity builds and maintains healthy, lean muscle mass and ensures skeletal density. Catabolic activity breaks down nutrients into energy the cells and body use to function. One measure of healthy anabolic activity is lean muscle mass and good recovery time from injury, illness and athletic activity.

Adaptogens offer a normalizing, restorative influence on all physiological levels. During stress, our bodies use more metabolic energy. Adaptogenic botanicals support the cell's capacity to manufacture and use energy economically. They are found to enhance cellular enzymes and mitochondrial function along with mRNA (messengerRNA) and tRNA (transcriptionRNA) capacity. Adaptogens also act as redox modulators to protect the cell membrane from damage.

EXERCISE BENEFITS ALL AGE GROUPS

Nutrition, exercise and androgen levels all play a role in maintaining lean muscle mass and bone mass. Exercise is essential for metabolic homeostasis during all stages of life. Studies show that appropriate strength and aerobic fitness training for adults in the 60 to 80 age group can give results similar to those achieved in far younger adults. Improvements with 20% to 30% increase in aerobic fitness are attributed to the plasticity of skeletal muscle, along with cardiovascular and muscular system adaptations. Strength resistance training resulted in great improvement in strength including factors such as walking speed, balance, climbing stairs and others.¹

ECDYSTERONES

Ecdysterones (ESs) are naturally-occurring sterols that control cell proliferation and growth and the developmental cycles of insects and crustaceans. ESs found naturally in many plants, are complex, steroid-based compounds with unique qualities. Included in this group are compounds such as ecdysterone, turkesterone, ajugasterone and others. They are found to exert powerful anabolic activity, promote

physical and mental performance and to enhance increased strength and stamina. Their anabolic influence works through multiple pathways without either direct or adverse effect on hormonal balance. They are found to have no direct hormonal effect, but rather provide precursors to hormonal synthesis. They can also act as hormonal-binding site receptors.⁴

ESs were first isolated from plants in the 1970s by Russian scientists who were particularly interested in their benefits for athletes.⁵ Since then they continue to be widely studied. ESs are classified as ergogenic anabolic compounds because they improve work and exercise capacity and favor the formation of substrates such as proteins, glycogen and fats. This enhances development of healthy tissues and can facilitate recovery after athletic training. Under increased stress or prolonged workloads, stressed muscular tissues begin to break down structural proteins to compensate for energy deficits. Enhancing protein anabolism helps the body replace these lost proteins. The natural and safe stimulation

of protein biosynthesis is thought to occur through the ESs' ability to accelerate tRNA processes.^{6,7}

ESs are found to significantly enhance immune response.^{6,7} They increase ATP production in the liver, which enhances redox balance. They effectively block free radical processes of oxidative stress.⁸ ESs have also been used as a safe anabolic compound to build heart muscle, enhancing recovery after heart attacks.⁹

In original Russian studies, a balanced adaptogenic formula given to Olympic athletes and cosmonauts was found to have a synergistic effect when compared to any single adaptogenic herb administered individually.¹⁰⁻¹² Because of their ubiquity in plants, humans are exposed to ecdysterones daily. Ingested ecdysterones survive exposure to gastric acid and are rapidly absorbed into the enteric blood vessels. Excretion is primarily via the liver.^{13,14}

Key Botanicals that Promote Anabolic Metabolism



Rhaponticum (*Rhaponticum carthamoides*)

R. carthamoides grows in the pristine alpine and subalpine zones and alpine meadows of Southern Siberia. The root and underground stems of Rhaponticum are valued as powerful medicines in Siberian folk medicine where it has been used for centuries to treat fatigue, anemia and impotence. Noted for its ability to support recovery from disease,¹⁵ Rhaponticum was also used to strengthen those suffering from weakness after illness or from overwork.¹⁶

Rhaponticum is an adaptogenic herb that specifically helps prevent the catabolic state seen with chronic stress. A rich source of potent ESs, Rhaponticum has been researched for over 30 years. It is acknowledged for its powerful adaptogenic ability and found to prevent the catabolic state seen with chronic stress.^{13,14,18}

In clinical studies, a standardized extract of Rhaponticum revealed anabolic properties attributed to its phytoecdisterone constituent.^{4,15-17} It is noted for its ability to increase protein biosynthesis and to enhance physical and mental work capacity along with physical performance and endurance. It modulates immune function, exerts antioxidant activity and enhances cardiovascular functions.^{16,17}

Rhaponticum is high in flavonoids, including quercetin and kaempferol.^{15,20} It also contains lignans, carotenoids, tannins,

resins, vitamin C and glycosides. The polysaccharide-rich glycoside constituents contribute to Rhaponticum's immune-enhancing functions.²⁰⁻²⁷ The flavonoids are believed to be the compounds responsible for *R. carthamoides* antioxidant activity. Out of 88 plants tested for antioxidant activity, Rhaponticum demonstrated the strongest activity.²⁰

It is especially studied due to its naturally-occurring anabolic ecdysteroids.^{4,16} The biological activity of Rhaponticum is attributed to the phytoecdisterone content, which influences metabolic processes.¹⁹ Rhaponticum contains a large number of ESs including ecdysterone and turkesterone.²⁶ Turkesterone is found to provide the most potent anabolic activity of the known phyto-ESs.^{6,7,25} Over 25 ESs have been identified in Rhaponticum.²⁷

Rhaponticum extract (RE), standardized for its ES content, is found to exert significant influence on metabolic processes and to enhance adaptation to stress. It promotes protein anabolism and increases ATP production in the liver, supporting increased rate of oxidative phosphorylation. RE improves physical work capacity, movement coordination, enhances athletic performance and helps build lean muscle mass.^{4,8,28}

Studies were conducted in seven Moscow clinics and RE was found to improve both the physical and mental state of patients. Benefits included increase in muscle tone, normalized body

weight and increased muscle work capacity even in those with protein synthesis disorders.²⁹ RE is reported to improve vascular perfusion of muscle and brain tissue.³⁰

Studies report that RE increases protein anabolism to build lean muscle and enhance loss of body fat.^{9,16,30} This has led to its use by athletes to support strength and endurance.¹⁶ RE improves the capacity for physical work, motor coordination and enhances athletic performance.⁹

Researchers find that RE helps prevent fatigue by increasing non-specific resistance and supporting mental and physical performance.^{13,14} It also facilitates recovery after intensive activity.⁹ In a study with 112 athletes, 89% of those given RE reported faster recovery from fatigue and improved competitive sports performance. Their tested speed and strength qualities all significantly improved compared with the control group, which received a placebo.⁴

Rhaponticum powerfully improves adaptive capacity and normalizes function in many physiological systems. It is found to enhance sleep, appetite, mood, and both physical and mental work performance under stressful conditions.²⁸



Shilajit (*Asphaltum bitumen*)

Shilajit, also called Mumie, is found in the Himalayas, in other areas of Asia and in Norway where it is gathered in small quantities from steep rock faces at altitudes between 1000 and 5000 meters.^{31,32} The Sanskrit word Shilajit means “rock-invincible”. The name Mumie translates as “destroyer of weakness”.³¹

Ayurvedic medicine values Shilajit as a rejuvenative herb. It exerts pronounced anabolic activity, accelerates protein and mineral metabolism, increases lean muscle mass and helps build bone density. The Russians have researched Shilajit since 1910. As a result of their findings it was used as a restorative and anabolic tonic for elite Russian athletes.³³

This unusual natural compound is a compact mass of vegetable organic substances that forms a gummy tar-like substance. It is mainly composed of humus and an organic composition that changes over time. It is found to contain many types of plant fibers and other fossilized components along with earthy matter, which seeps through rocks infiltrated with spring water.

Shilajit is sometimes called mountain rock juice or balsam of rock. This substance has a history of use as a rejuvenative and adaptogenic compound for thousands of years.³⁴ It is estimated to contain about 80% decomposed resin-bearing plants. Humus contains fulvic and humic acids, which are high in phenolic compounds. It also contains benzoic acids, flavonoids, sterols, minerals including calcium, magnesium, and silica, and microelements.³⁵

In traditional Russian and Ayurvedic medicines, Shilajit is known as a powerful anabolic that also stimulates bone regeneration. Data suggests that because Shilajit is a potent stimulator of osteoblastic differentiation of mesenchymal stem cells and an inhibitor of osteoclastogenesis, it may be of clinical benefit in the treatment of osteoporosis in humans.³⁶⁻³⁹ Shilajit is found to exert significant adaptogenic activity comparable to *Panax ginseng*.⁴⁰



Acticissus (*Cissus quadrangularis*)

An ancient medicinal plant native to Ceylon, India and Africa, Cissus is used in Ayurvedic medicine to support healthy bones, ligaments and tendons. It contains ketosterones, which are found to enhance healthy anabolic metabolism. Studies find that Cissus acts as an anabolic restorative with androgenic capacity.^{41,42}

In Ayurvedic medicine, Cissus is revered for its ability to speed healing from bone fractures. Modern research finds it does this through its action as a glucocorticoid antagonist.⁴¹ Although most of the research on Cissus centers around bone healing, the possibility exists that Cissus may act to improve the healing rate of connective tissue in general, including tendons.⁴³

Considered to be anti-osteoporitic, Cissus benefits bone remodeling and increases bone tensile strength. Clinical trials find that healing time from fractures increased from 33% to 55% higher than the control group. It is also found to benefit bones weakened from use of cortisol.⁴⁴



Epimedium (*Epimedium sagittatum*)

Epimedium is a powerful herb with an ancient history that is highly researched in modern times. Famously known as “horny goat weed”, Epimedium has long been used as an aphrodisiac to enhance both sexual energy and erectile function. The famous Chinese herbal book of remedies *Shennong Ben Cao Jing*, written around 1200 BC, describes the use of Epimedium for impotence. In modern times it is found clinically useful for impotence, fatigue, low sperm count, low libido, spermatorrhea and sterility.⁴⁵

Known as Yin Yang Huo in Chinese medicine, Epimedium is traditionally combined with other herbs to ameliorate its strong action as Kidney Yang tonic. Valued to support energy, youthful vigor and a healthy libido, Epimedium is most often included in longevity tonics such as the famous *Two Immortals* formula of Chinese medicine.

Modern research finds that Epimedium supports neurological balance as it modulates catecholamine production and exerts a normalizing effect on the HPA (hypothalamic-pituitary-adrenal) axis.⁴⁵ This is one reason Epimedium is found useful in cerebral deficiency with memory loss, depression, hormonal

deficiency, fatigue, impotence, low sperm count and sexual disinterest.⁴⁵

Epimedium flavonoids are found to possess the ability to influence profound regeneration of adrenocortical pathways where there is HPA axis dysfunction. They also assist HPA axis response and hormonal recovery after long-term stress or glucocorticoid exposure.^{46,47}

Epimedium supports androgenic balance.⁴⁸ In several studies, Epimedium extract was found to increase muscle function and integrity and to support health and vigor.⁴⁹ Epimedium benefits the cardiovascular system as it helps reduce vascular resistance, which supports healthy blood flow.

Flavonoids are one of the active constituents of Epimedium along with polysaccharides, natural sterols and fatty acids. Icariin is considered to be the key flavonoid in Epimedium. Both Epimedium and icariin are found to be protective against oxidative stress at the cellular level, supporting healing and repair of aging cells.⁵⁰⁻⁵⁴

Epimedium and Bone Mineral Density

Epimedium demonstrates anabolic and bone-protective effects. Many studies find that Epimedium supports healthy bones through several pathways including promoting bone formation and mineral content, and contributing to both bone density and architecture.^{50,51}

When Epimedium extract (EE) was given to animals with osteoporosis, the lumbar bone mineral density was significantly higher in the EE group. There was also a marked reduction in IL-6 expression – IL-6 may play a role in the development of postmenopausal osteoporosis.⁵⁵⁻⁵⁷

Other studies report that EE inhibits bone loss and in vivo studies show that EE promotes bone formation through increasing mineral content.⁵⁸⁻⁶⁰ Flavonoid extracts from Epimedium, such as icariin, are found to benefit bone density, promote osteoblast development and to prevent osteoporosis in animals.⁶¹⁻⁶³

Cordyceps (*Cordyceps sinensis*)



Known in China as “winter worm summer grass” or the “caterpillar mushroom,” Cordyceps is a parasite fungus that traditionally grows on the larvae of caterpillars and other hosts that provide a growth medium for the mycelia.

Li Chih Shen, a renowned sixteenth century Chinese herbalist, praised Cordyceps for its ability to invigorate and tone the entire body. Chinese herbalists revered it as a respiratory

tonic. At the same time it deeply nourishes the deep reserve (Kidney) energy that supports healthy lung function and overall vitality and stamina. Cordyceps contains polysaccharides that contribute to its immune-modulating influence.⁶⁴

Cordyceps first gained international attention when it was discovered that Chinese Olympic athletes included Cordyceps as part of their daily adaptogenic herbal training formula. Studies confirm that Cordyceps increases endurance, vigor and athletic training and performance.^{65,66}

Recognized for its liver- and kidney-protective qualities, Cordyceps is reported to be especially beneficial for those with chronic kidney disease.⁶⁷⁻⁷⁰ It also demonstrates high antioxidant activity.^{71,72}

Cordyceps extract is found to inhibit brain aging, modulate endocrine function⁷³ and to restore sexual function with the ability to replenish sperm and support health testosterone levels.⁷⁴ Cordyceps is found to modulate hormonal balance and can increase testosterone.^{75,76}

For more information on any of the ingredients listed here, including extensive research or individual monographs compiled by Donnie Yance, please email info@naturaedu.com.

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