Whey Protein and Anabolic Nutrients to Optimize Metabolic Health, Athletic Performance, and Immune Function

Co-authored by Donald R. Yance, RH (AHG), CN and Suzanne E. Sky, L.Ac., MTOM

Discussion

WHEY PROTEIN

Whey, the highly nutritious liquid expressed from milk during the cheese-making process, is traditionally prized in many cultures for its nourishing qualities. Its long historical use for numerous health benefits is borne out of a large body of research over the last 100 years. Whey constitutes about 20% of milk protein while the remainder is casein, the curds which form cheese.

Whey has an excellent profile of amino acids and serum milk proteins including the b-lactoglobulins, a-lactalbumin, immunoglobulins, lactoferrin, lactoperoxidase and glycomacropeptide. Whey proteins contain high amounts of the branched-chain amino acids (BCAAs) leucine, isoleucine and valine, which are vital factors involved with muscle growth and repair. Studies show whey proteins are quickly and efficiently digested and assimilated, and readily raise plasma concentrations of amino acids. They are found to enhance mineral absorption, protein synthesis and to support reduction in blood glucose and lipid levels.

Whey proteins offer high nutritional value as they contain all the essential amino acids in higher concentrations than vegetable protein sources. Because of this, research finds that whey proteins benefit metabolic health and are helpful in preventing and treating many metabolic and other conditions including obesity, diabetes and oxidative stress.[1-5]

One human study reports that supplementation with whey protein resulted in greater weight loss and a reduction of body fat while maintaining lean muscle mass. Whey proteins are found to play a role in glycemic control through multiple pathways, including their stimulation of incretin hormones, which enhance release of insulin during fasting and after meals and improve insulin sensitivity.[1-5]

AMINO ACIDS: ESSENTIAL FOR LIFE

Protein is essential for life and is a part of our everyday diet. During times of heavy stress, trauma, debility, recovery from illness or from strenuous exercise and athletic training, the body requires larger amounts of high-quality protein to reduce muscle breakdown, maintain lean muscle mass, increase cellular energy and improve cellular detoxification and recovery. All these complex processes and activities work together to maintain homeostasis and the adaptive process of allostasis.

Amino acids provide cellular building blocks for the proteins essential to maintain health and healthy anabolic reserves. Involved with almost every aspect of our physiology, amino acids, proteins and their more complex molecular forms of peptides and polypeptides (which are groups of 50 or more amino acids) perform multiple and diverse physiological functions. They serve as structural material for cells, enzymes and cell-signaling molecules. They play key roles in mediating the stress response, facilitating cellular healing and repair and function in regulatory and protective roles.

Proteins are involved with cell movement and transport of molecules and ions through cell membranes. Genomes direct the sequencing of tens of thousands of proteins. Immunoglobulins, also known as antibodies, are glycoprotein molecules. They function as part of the humoral immune response that identify and bind to antigens such as microbes to destroy them. There are many kinds of immunoglobulins, which are very complex in structure and function.[6]

Whey Protein Concentrate: Highest Protein Value

While there are multiple methods of processing whey to derive a high-protein content, the most effective method to preserve the naturally bioactive constituents of whey is through the least processing. This form of whey, known as whey protein concentrate (WPC), is widely studied and renowned for its health benefits. WPC preserves up to 99% of the protein peptides in their biologically active state and naturally contains all the essential amino acids in balanced amounts.

WPC offers the highest biological protein value of any food and is a beneficial addition to most health programs. It is an excellent source of the sulfur amino acids (methionine and cysteine) and the branched-chain amino acides (BCAAs - leucine, isoleucine and valine). WPC scores highest in three markers: 1) Protein Efficiency Ratio (PER – which measures the quality of proteins), 2) Biological Value (BV) and 3) Protein Digestibility Corrected Amino Acid Score. Its BV is 100, which is the maximum score.[7-10]

WPC is rich in alpha-lactoglobulin, beta-lactoglobulin, bovine serum albumin and immunogloblins IgG1, IgG2, secretory IgA and IgM. Whey protein also contains enzymes such as lactoperoxidase and the iron-binding protein lactoferrin. Minerals include calcium, potassium, sodium, phosphorus. Vitamins include A, C, B1, B2, B3, B5, B12, folic acid and biotin.[7-11]

WPC and Healthy Muscle Mass

WPC, well-known in the fields of sports nutrition, is optimal for many bodybuilders and strength and endurance athletes. During strenuous exercise, the body requires more protein to support its muscles and prevent muscle breakdown. One study found WPC corrected the immune suppression often seen in athletes suffering from over-training syndrome.[12]

Whey is recognized to enhance exercise performance and recovery time. It also enhances muscle size and strength, partially due to the high constituency of BCAAs, which provide efficient substrate for the synthesis of new proteins and enhance anabolic reserves in the muscles.[13-15]

BCAAs are valued by athletes to enhance recovery time and are involved with numerous metabolic processes. The BCAA leucine is particularly researched for its benefits to protein synthesis and energy production.

WPC also greatly benefits those recovering from metabolic or serious illness where it is essential to support healthy muscle mass and anabolic reserves. In addition, WPC is shown to promote fat loss while sparing muscle in obese people during weight loss.[16,17]

WPC and Metabolic Health

Metabolic health involves metabolism of carbohydrates, fats and proteins to maintain allostasis, healthy cellular function and anabolic reserves. Dysfunctional metabolism can manifest as decreased insulin sensitivity, poor glucose and lipid profiles, oxidative stress, chronic inflammation and a host of other issues. Obesity, cachexia, sarcopenia and loss of muscle mass and bone density are problematic and multifactorial. Many studies show direct correlation between dietary whey proteins and prevention of metabolic disorders and also demonstrate their benefit in regaining metabolic health.[2]

Much of the research investigates the role of whey in preventing or treating obesity, diabetes, mellitis and other metabolic conditions. Metabolic syndrome, including type 2 diabetes, is regarded as a major global health concern of the 21st century.[1,2] Whey proteins are found to reduce serum glucose in healthy individuals and to help reduce obesity while improving lean muscle mass.[1] Whey proteins demonstrate the ability to exert insulinotropic influence and to reduce postprandial glycemia in a both healthy and type 2 diabetic humans.[2-4]

Whey proteins are found to slow gastric emptying, stimulate incretin hormone secretion and play a role in glucose homeostasis. The amino acids in whey can directly stimulate beta cells of the pancreas to secrete insulin, which contributes to reduced postprandial glycemia. They are also found to influence the gut-brain axis and the hypothalamus.[18]

The ability of whey to stimulate pancreatic beta cells is attributed to its amino acid constituents. While all amino acids can stimulate insulin secretion and reduce serum glucose, the BCAAs are found to have potent insulinotropic properties and to be more insulogenic than other amino acids. The complex mechanism of action involves mitochondrial metabolism.[18]

WPC and Bone Health

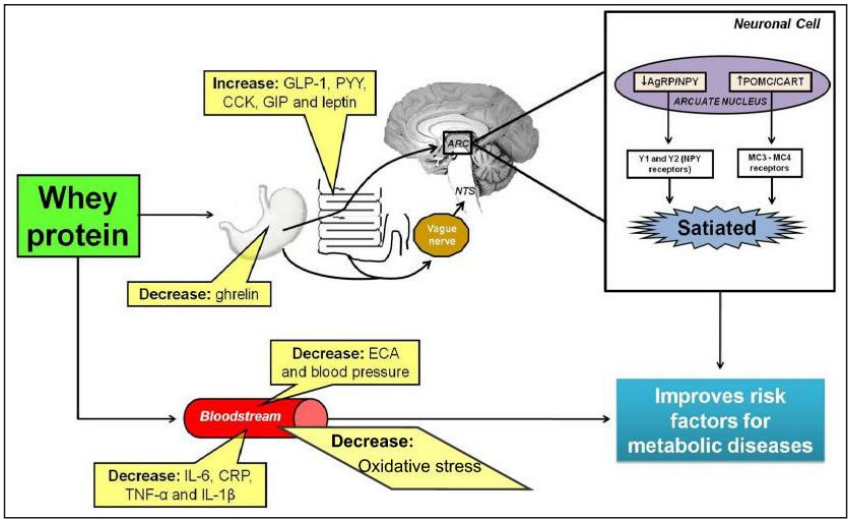
Healthy muscle mass and bone density are integrally linked.[19] Maintaining metabolic health, lean muscle mass and a healthy diet and exercise program are known factors that influence bone density along with heredity and environmental factors.

WPC appears to play a direct role in bone growth. Researchers found that rats fed WPC showed increases in bone strength and in bone protein such as collagen. Whey protein was found to stimulate total protein synthesis, DNA content and to increase hydroxyproline content of bone cells in a dose-dependent manner.[20,21] Components of whey (the milk basic proteins) are shown to stimulate proliferation and differentiation of osteoblastic cells and to suppress bone resorption.[5]

IMMUNONUTRITION

Since nutritional status is a determining factor in immune response, there is a large body of research on the role of nutrients in immune function. Both whey protein and glutamine are recognized as immunonutrients that are beneficial to help prevent illness, enhance healthy immune function and are beneficial as part of a restorative program.[22,23]

Whey proteins, nutritionally beneficial to the immune



Main mechanisms of action of whey protein in protection of risk factors for metabolic diseases such as obesity, type 2 diabetes mellitus, hypertension, oxidative stress and metabolic syndrome.
(See reference #1)

system, are also found to enhance endogenous antioxidant enzymes including glutathione peroxidase, catalase and SOD (superoxide dismutase).[1] Glutathione (GSH), found in most organisms, is a tripeptide formed from the amino acids glutamine, cysteine and glycine. Well-known for its cyto-protective functions and activity as an intracellular antioxidant, it is the principle protective mechanism of the cell and a crucial factor in immune response.

The sulphur-containing amino acids cysteine and methionine occur in high amounts in whey protein. WPC offers a rich source of glutathione precursors, notably cysteine, in an effective delivery system for GSH replenishment to support and facilitate immune response.[1,5,24-27] WPC is found to decrease oxidative stress markers and expression of proinflammatory markers (IL-1b, IL-6 and TNF-a) in obese, diabetic and stroke patients.

Whey contains many types of enzymes, some of which are able to catalyze molecules and can benefit antioxidant processes and also promote inhibition or death of bacterial species. The lactoperoxidase enzyme in whey possesses important antimicrobial properties.[1,5]

SUMMARY OF BENEFITS

WPC offers a naturally rich amino acid profile that supports multiple health benefits. WPC enhances anabolic function, supports lean muscle mass, healthy weight loss, skeletal health and bone density. It encourages metabolic health through enhancing insulin secretion and supporting healthy blood glucose levels. The immune-enhancing components of whey support immune modulation and antioxidant capacity to support a healthy cellular environment.[28-29] Researchers find whey proteins to be hepato-protective and studies show whey protein facilitates a decrease in elevated liver enzymes.[1]

Whey Protein & Anabolic Nutrients for Metabolic Health, Athletic Performance & Immune Function

Native (Non-denatured) Whey Protein Concentrate

Native WPC is non-denatured. Denaturing of proteins can lead to partial or complete loss of their biological activity. Native WPC is minimally processed at low heat to preserve the full range of its fragile immune-modulating protein fractions and undenatured amino acid structures, thus retaining their biological activity. This method also preserves the natural concentrations of important milk proteins, milk fats, lactose, enzymes, immunoglobulins, lactoferrin and other nutrient content of whey. Most of these are removed during other methods of processing.

Two key components of WPC are immunoglobulins and lactoferrin:

Immunoglobulins

Immunoglobulins (Igs) are glycoproteins that act as antibodies. Their associated glycans are found to influence antibody function. Igs that are aberrantly glycosylated are associated with diverse conditions including autoimmune conditions such as rheumatoid arthritis and can also affect other antibody functions.[6]

Igs are involved with multiple immune functions. They can act as cell-surface receptors for antigens that facilitate cell signaling and cell activation. They can also act as molecules to individually bind and neutralize antigens.[6]

There are many classes of antibodies such as IgG (gamma-globulin), which is about 75% of antibodies in adults. Immunoglobulins constitute about 10% to 15% of whey protein[5] and are the primary protein found in colostrum. They demonstrate immune-modulating influence.[5] There are four classes of Igs in whey protein: IgG, IgA, IgM, IgE. These are found to offer antioxidant protection and to enhance immunity.[1]

While beta-lactoglobulin represents about half of the total protein in whey from cows, human milk contains none. Beta-lactoglobulin contains essential amino acids (EAAs) and is especially rich in BCAAs.[5] One of the main proteins found in both human and cow milk is alpha-lactalbumin. Usually whey protein is about 20% to 25% alpha-lactalbumin, which contains a wide variety of amino acids including EAAs and BCAAs.

In addition to the above-mentioned properties, alpha-lactalbumin chelates heavy metals and reduces oxidative stress partially due to its iron-chelating ability.[5] Alpha-lactalbumin contains a higher tryptophan content and is rich in lysine, leucine, threonine and cysteine. It is able to bind with minerals, including calcium and zinc, benefitting their absorption.[5]

Lactoferrin

Lactoferrin, an iron-binding glycoprotein, constitutes about 1% to 2% of whey protein. Found in both whey and colostrum, it naturally occurs in breast milk, tears, saliva, bile, blood and mucus.[5] Lactoferrin, found in both cow and human milk, is particularly concentrated in colostrum, the pre-milk substance newborns receive at birth.

Since lactoferrin is able to bind with iron, it helps us derive iron from the foods we eat and deliver it to the areas of the body where it is needed. Involved with the immune system response, plasma levels of lactoferrin are elevated as it is released from neutrophils during infection, inflammation and iron overload.[5]

Lactoferrin also helps produce alpha-interferon, which has profound action to enhance immune function.[30] Lactoferrin demonstrates the ability to stimulate NK cells, neutrophils and macrophage cytotoxicity. It modulates TNF and IL-6 and inhibits production of pro-inflammatory cytokines.[1,5] Lactoferrin is found to be antioxidant, antimicrobial, antiviral and antifungal. It is also found to promote the growth of beneficial bacteria in the colon.[5]

Lactoferrin demonstrates an anabolic effect on skeletal tissue. Lactoferrin inhibits bone breakdown and is found to stimulate the proliferation of bone-forming cells, osteoblasts and cartilage cells.[31-34] Researchers find that lactoferrin works through receptors on bone-forming cells to promote bone growth.

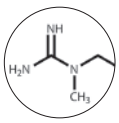
Colostrum

Colostrum is a pre-milk liquid produced by mammals before the onset of lactation. Rich in natural antibodies and compounds that form the foundation of the immune system and help colonize the colon with beneficial bacteria, colostrum has been used for thousands of years for health promotion. Colostrum contains numerous immune and growth factors that are vital to the newborn but can also enhance the health of children and adults.

Colostrum provides essential components of the immune defense system including immunoglobulins and lactoferrin.[35] Research studies demonstrate that colostrum supports healthy human growth, optimal digestion and a strong and vital immune system. Colostrum is widely studied and recognized for its importance in establishing immune function and intestinal health in infants and in adults and for its ability to enhance human growth. Recent studies confirm its importance for human growth, immune function and intestinal health. It contains a small molecular weight moiety called transfer factor, an immune activator that acts as a messenger to the immune system preparing it for defense-specific antigens.[36-38]

Colostrum is found to enhance immune system response and to help modulate an overactive immune response. It enhances bone and lean muscle mass. Colostrum is also found to exert potent antioxidant and anti-inflammatory properties.

Magnesium Creatine Chelate



Magnesium Creatine Chelate (MCC) benefits ATP (adenine triphosphate) synthesis, exerts a positive anabolic influence and facilitates muscular hydration and endurance. It is recognized for its

benefits in sports nutrition, healthy aging and cardiovascular health along with other benefits.

Creatine, an essential compound in physiological function, plays a key role in energy metabolism where it regenerates ATP and helps supply energy to muscles. Naturally synthesized in the body from the amino acids glycine, arginine and methionine, creatine increases muscle growth, strength and endurance. It is found to increase muscle creatine and phosphocreatine and to create a higher rate of ATP resynthesis. This results in delayed onset of muscle fatigue and facilitates rapid recovery during repeated rounds of high intensity exercise.[40-45]

Sports Nutrition: Enhances Endurance, Strength-Training and Anabolic Reserve

In a placebo controlled trial, MCC was compared to creatine monohydrate and placebo, and MCC was found significantly superior to creatine monohydrate in enhancing performance and recovery.[46] Magnesium creatine chelate supplementation was found to allow runners to exercise longer before reaching exhaustion, as compared to the control group.[47]

Researchers find creatine supports recovery and endurance in high-performance and strength-training athletes. Studies report that those supplementing with creatine as compared to placebo showed greater strength gains during resistance training, with increases in endurance and muscle mass. Creatine supplementation is found to help reduce muscle fatigue.[48-53]

Cardiac and Cardiovascular Health

Human studies report that creatine enhances cardiac and cardiovascular health. Creatine is found to improve cardiac function with an overall better force of heart contraction and a more complete output of blood from the heart. Studies report it enhances recovery and helps improve heart function after chronic heart failure.[54,55]

Healthy Aging and Chronic Conditions

In the field of sports nutrition, creatine is recognized for its benefits to enhance exercise tolerance, increase muscle strength and promote lean muscle mass. These benefits extend to the elderly and to those with chronic conditions where it is found to benefit people with myopathies, neurodegenerative disorders, rheumatic disorders and type 2 diabetes.[56-58]

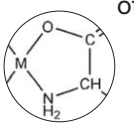
Levels of energy-producing muscle phosphocreatine decline with aging. Studies show that supplemental creatine can increase available muscle stores of creatine and enhance phosphocreatine production in older people, even to levels similar to those of youthful adults. Creatine can also help reduce muscle fatigue and is found to help attenuate age-related muscle atrophy and strength loss.[56-59]

Creatine may also benefit those with chronic fatigue and fibromyalgia. Lower levels of creatine phosphate and ATP were found in people with fibromyalgia compared to control subjects.[60]

Additonal Protective Functions

Creatine is found to be protective against neuro-degenerative disorders and to support healthy neurons and mitochondrial function.[61-64] Research suggests creatine can raise growth hormone levels equal to that of intense exercise. Growth hormone plays a vital role in regulating body fat levels, immune function, muscle mass, wound healing and bone mass along with other functions.[65]

Magnesium Glycyl Glutamine Chelate



Magnesium glycyl glutamine (MGG) in a chelated form of glutamine, magnesium, and glycine provides bioavailable forms of these nutrients to enhance its anabolic effectiveness. MGG provides a biocompatible form of magnesium, an essential agent for energy production. Glycine is shown to increase muscle strength partially through enhancing growth hormone and facilitating creatine synthesis.[66,67]

Glutamine is the most abundant amino acid in the blood and levels decline markedly during periods of injury, illness, trauma, radiation therapy and stress. This decline is a contributing factor to muscle wasting. Glutamine supplementation is found to help prevent immuno-suppression and muscle atrophy during periods of stress.[68]

Although glutamine is not an essential amino acid, it is considered conditionally essential because it becomes essential during times of stress and during the healing process. Glutamine supplementation is found to reduce rate of infection, degree of inflammation, length of hospital stay and mortality. It improves gut barrier function and immune function, especially cell-mediated immunity in critically ill patients.[69] Research shows numerous benefits of glutamine in experimental models of critical illness, including attenuated proinflammatory cytokine expression, improved gut barrier function, enhanced ability to mount a stress response and improved immune cell function.[70]

Glutamine serves as a nitrogen donor and a carbon donor. It is an important muscle-building amino acid and helps

replenish muscle glycogen after exercise. Glutamine is utilized as a source of energy and for nucleotide synthesis by rapidly dividing cells, such as those of the intestinal lining and certain immune cells (thymocytes, lymphocytes and macrophages). Glutamine supports intestinal function and is found to enhance healing from gastric and peptic ulcers. It is a vital nutrient used by both the intestinal immune cells (the lymphocyte-rich Peyer's patches) and mucosal cells.[68]

Glutamine is found to exert profound physiological influence including immuno-modulatory, anti-catabolic/anabolic and gastrointestinal mucosal-protective actions. In the brain, glutamine is a substrate for the production of both excitatory and inhibitory neurotransmitters (glutamate and gamma-aminobutyric acid, known as GABA). It also demonstrates antioxidant activity as a precursor amino acid for the production of glutathione.[71-75]

Fructooligosaccharides (FOS)

FOS are inulins, a naturally-occurring group of fructose-containing carbohydrates. FOS naturally occurs in onions, leeks, chicory, Jerusalem artichokes and burdock root. FOS fibers are not absorbed by the stomach or small intestine but are utilized as a food by the colon microflora, particularly the bifidobacteria. Because of this, FOS is often used to help potentiate the growth of a healthy colon flora and is classified as a prebiotic.[76-79] Research has shown FOS taken daily selectively results in significant increases (approximately ten-fold) of beneficial bifidobacteria in the colon with corresponding decreases in problematic bacteria.[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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