

## Collagen Peptides plus Whey protein powder White Paper

### Introduction

HumanN has introduced a new protein blend, **Collagen Peptides and Whey Protein**, to support both connective tissue and skeletal muscle synthesis and repair. It is composed of 10 g of collagen hydrolysate, 15 g of whey protein concentrate, and ProHydrolase, a digestive enzyme complex that increases protein digestion and absorption. The combination of collagen hydrolysate and whey protein concentrate makes a powerful therapeutic protein supplement. By combining these two sources of dietary protein, it is possible to provide the appropriate amino acid profile to rapidly activate synthesis of both skeletal muscle and connective tissue such as skin, nails, hair, bone, ligament and tendons. Moreover, there are potentially numerous health benefits when daily supplementing one's diet with this protein complex, including maintenance of bone and muscle tissue, reduced joint pain and inflammation, improved body weight control, and better blood pressure control to name a few. To ensure its rapid and complete digestibility and absorption, ProHydrolase has been added to the complex. This combination of dietary proteins and digestive enzymes is unmatched for its health benefits.

### Importance of Dietary Protein

It is no secret that as we age there is a decline in our muscle mass and strength. The loss of muscle mass and strength is generally associated with frailty, weakness, reduced mobility, functional disability and injuries due to falls. However, over the last 10 years researchers have found a high correlation between muscle strength and cardiovascular disease, certain forms of cancer and all-cause mortality (1-4). With age there is also a decline in the quality and quantity of connective tissue (5, 6). Connective tissue makes up the matrix that holds our cells and organs together, and provides support, connection and separation between body parts. Collagen, a fibrous protein, is a significant component of all connective tissue, and is the most abundant protein in our body. Tissues with high concentrations of collagen include skin, hair, nails, tendons, ligaments, cartilage, blood vessels, bone, muscle and the digestive tract (7). Observable declines in connective tissue that occurs with age include loss of skin elasticity and thinning, increased fragility and thinning of hair, brittle nails, a stiffening and soreness of joints, bone loss and reduced flexibility and strength. These changes, although not immediately apparent, begin in our early 30's and start to accelerate around 45 to 50 years of age similar to the loss of skeletal muscle (5,8).

The loss of muscle and connective tissue with age can be due to a number of factors including genetic characteristics, inadequate physical activity, and poor health habits such as smoking and insufficient sleep. However, the most important factor is likely inadequate dietary protein consumption. It is now evident that with advancing age the amount of dietary protein necessary to properly maintain muscle mass and connective tissue increases (9, 10) while protein consumption generally declines. It has been estimated that about 35% of older men and women ingest less than the minimum recommended daily protein allowance (RDA) of 0.36 g per lb. of body weight. Moreover, recent research suggests that older individuals' protein consumption should make up

approximately 30 to 35% of the total calories consumed per day, which equates to between 0.55 to 0.68 g of protein per lb. of body weight (**10**). However, all proteins are not equal and the type as well as the amount of dietary protein consumed can have a major effect on protecting against muscle and connective tissue loss. Whey protein has been found to be the most effective dietary protein for protection of muscle tissue (**11-13**), while repair and growth of connective tissue is best served by a dietary collagen hydrolysate supplement (**14-16**).

### **Protein Differences and Metabolism**

Protein is one of the 3 basic macronutrients in our diets with the other two being carbohydrates and fats. Protein is made of peptides, which are chains of amino acids. Amino acids serve as the building blocks for repair and growth of all tissues of the body. There are 20 amino acids that the body requires for this purpose. Of these 20 amino acids, 11 can be produced in the body itself and are referred to as non-essential amino acids, while 9 are referred to as essential amino acids because they have to be obtained through dietary means. Not all dietary proteins are equal in nutrient value because each protein has a unique amino acid profile. Proteins can be classified as complete or incomplete proteins. A complete protein is one that has an adequate proportion of all 9 essential amino acids necessary for normal growth, while an incomplete protein is one that lacks one or more of the essential amino acids or does not have an adequate proportion of one or more of the essential amino acids.

When protein is consumed, it is broken down in the digestive tract to peptides, which are small chains of amino acids. It is then further digested into individual amino acids. These amino acids are taken up from the digestive tract to the circulatory system and carried to all tissues of the body. There they are reassembled into the protein needs of the cells they enter. For example, amino acids in muscle can be assembled into contractile proteins like actin and myosin, and in connective tissue they may be used to form collagen or elastin. However, the availability of the correct amino acids will depend on the dietary protein consumed. To build and repair muscle tissue, whey protein is one of the most appropriate that can be consumed because of its high concentration of branch chain amino acids. The branch chain amino acids are used extensively for muscle structure and contractile filaments. To build and strengthen connective tissue, dietary collagen protein is essential because collagen is a key component of all connective tissue. Collagen contains high amounts of the amino acids glycine, proline and hydroxyproline, which are required for repair and development of all connective tissue.

### **Collagen and its Benefits**

Collagen is a fibrous protein that provides tensile strength to connective tissue. There are a number of different types of collagen, but all contain very high concentrations of the amino acids, glycine, proline, alanine, hydroxyproline, hydroxylysine and arginine. Because of its unique amino acid profile, dietary collagen supplementation can provide a variety of health benefits.

Collagen is a major component of skin, nails and hair. Collagen supplementation has been found to increase tone and firmness of skin and improve nail and hair quality (**17-20**). Numerous studies support the use of collagen supplements to slow skin aging. Its supplementation helps increase skin flexibility and hydration, which helps increase the

smoothness and firmness of the skin (21-23). As little as 5 grams of collagen supplement per day for eight weeks has been found to reduce skin dryness and increase skin elasticity (23). It was also found that women who consumed a collagen supplement daily for 12 weeks experienced increased skin hydration and a significant reduction in wrinkle depth compared with women who did not receive the collagen supplementation (22). In addition, collagen supplementation appears to increase the protein elastin, which helps give skin its structure (21). Research suggests that regular dietary collagen consumption can help increase skin firmness, elasticity and smoothness, and slow the skin aging process.

Another important attribute of collagen supplementation is its ability to support joint health. Osteoarthritis is a disease of the joints. It occurs when the cartilage that protects the bones of the joints degenerates and results in bone damage and inflammation. It is the most common form of arthritis, affecting over 20 million people in the USA. Osteoarthritis can be very painful and severely limit movement and flexibility. Regular dietary collagen supplementation has been found to significantly limit joint pain and improve joint function in individuals suffering from osteoarthritis (24-26). For example, Crowley et al. (27) found that individuals with osteoarthritis treated with collagen supplementation for 180 days showed a significant reduction in joint pain, improved mobility, and a general improvement in quality of life. Schauss and colleagues reported that adults who consumed two grams of a collagen-based supplement daily for 70 days had a significant reduction in hip and knee joint pain and were better able to engage in physical activity than those who received a placebo (28).

The improvement in joint health following collagen supplementation is thought to be due to increased synthesis of collagen found in joint cartilage and ligaments (14, 29). Indeed, collagen supplementation is commonly used to help strengthen tendons, and ligaments, rope-like connective tissue that attaches muscle to bone and holds joints in place, respectively. Collagen makes up the largest percentage of protein in these tissues and is responsible for their tensile strength.

The improvement in joint health following collagen supplementation is not limited to individuals suffering from osteoarthritis. The administration of 10 g of collagen hydrolysate per day for 24 weeks was found to reduce joint pain at rest and during physical activity in young athletes with joint pain due to strenuous and prolonged exercise (25). Therefore, by virtue of dietary collagen's ability to repair joint cartilage, ligaments and tendons, collagen supplementation can effectively reduce joint pain, stiffness and inflammation resulting from joint damage and excessive use.

Not commonly known is that collagen is an essential component of bone. Research indicates that collagen supplementation has osteoprotective effects and may be beneficial as a treatment for osteoporosis (30). Collagen makes up the bone matrix or mold that holds calcium, phosphorus and other minerals. The storage of these minerals in the collagen matrix is what gives bone its strength and rigidity. As the collagen in bone declines, its mineralization declines and the bone becomes weaker. It is believed that insufficient consumption of protein and key minerals could potentiate the development of osteoporosis. In fact, a recent study showed that 5 grams of a collagen-based supplement provided daily for 12 months increased the bone mineral density of postmenopausal women by 7% compared to women who received a placebo (31). The improvement in bone mass was related to both an increase in bone formation and reduction in bone degradation.

Collagen fibers are also an important constituent of the digestive tract and the synthesis of collagen is an important nutrient for the repair of the intestinal lining. Leaky gut syndrome, which is caused by damage to the tight junctions in the intestinal lining, allows incompletely digested nutrients, and unwanted chemicals and toxins into the circulatory system. These unwanted substances can result in inflammation, oxidative stress, and disease. Collagen is a good source of glutamine, which can help repair the lining of the intestines, and reduce inflammation and oxidative stress associated leaky gut syndrome (32, 33). Collagen also helps regulate the secretion of gastric enzymes to ensure proper digestion while protecting against too much stomach acid (34). As a bonus, dietary collagen is an excellent appetite suppressant (35).

Finally, we know that protein supplementation after resistance exercise training is associated with an increase in muscle protein synthesis and training adaptation. Dietary proteins high in the amino acid L-leucine, such as whey protein and casein have been regarded as the most effective post exercise protein supplements for muscle development (36). Although the amount of L-leucine in collagen is relative low, there is evidence that collagen supplementation can be of benefit for the retention and development of skeletal muscle (37). In a recent research study, it was demonstrated that daily collagen supplementation could increase the muscle mass of individuals with sarcopenia. In this study, 27 frail men consumed 15 grams of collagen daily while participating in a resistance exercise-training program for 12 weeks. Compared to men who exercised but did not consume any dietary collagen, the men receiving the collagen supplement gained significantly more muscle mass and strength as well as lost more fat mass (37).

### **Whey protein and its Benefits**

Whey protein is a mixture of globular proteins found in whey, or the watery portion of milk that separates during cheese processing. The proteins that make up whey protein include  $\beta$ -lactoglobulin,  $\alpha$ -lactalbumin, glycomacropeptide, immunoglobulins, serum albumin, lactoferrin, lactoperoxidase and lysozyme. Whey protein is one of the most efficacious dietary proteins known. Aside from containing all 20 amino acids, whey has a very high concentration of essential amino acids and contains the highest amount of L-leucine of any protein known. L-leucine is responsible for activating protein synthesis, and its high concentration in whey protein accounts for the superior efficiency of this dietary protein to promote muscle and connective tissue protein synthesis (36, 38). It is also a good source of cysteine, an amino acid that is used to make glutathione in the body. Glutathione is an essential antioxidant found in all cells of the body, and is a major part of its defense system (39).

There is an abundance of research demonstrating the benefits of dietary whey protein supplements. When consumed post exercise, it enhances muscle protein synthesis, reduces delayed onset muscle soreness and damage, speeds muscle recovery and enhances training adaptation (40). Its ability to rapidly activate protein synthesis and the magnitude in which this occurs is unmatched. For example, it has been observed that consuming a whey protein supplement at rest or post exercise resulted in a greater rate of muscle protein synthesis than when consuming soy protein or casein. This was seen in both young and older men (12). Moreover, it was found that participants engaged in a 9 month resistance exercise-training program supplemented post exercise with whey

protein had greater increases in muscle mass and strength than participants that were supplemented with soy protein or carbohydrate (41).

When dieting, whey protein supplementation can be very beneficial. Caloric restriction not only results in fat loss, but can also result in substantial muscle loss. In this regard, Frestedt and colleagues (42) reported that a daily reduction of 500 kcal per day for 12 weeks significantly lowered the body weight of obese participants. There was no difference in weight loss between subjects that received a protein supplement or an isocaloric beverage. However, the participants that received the protein supplement had a greater loss of fat mass while maintaining more muscle mass. Protein supplementation also has been found to suppress appetite (43) and to be highly satiating (44). These effectiveness of whey protein appear to be more effective than other protein sources (44, 45) due in part to its high concentration of  $\alpha$ -lactalbumin.

As previously mentioned, whey protein is a good source of cysteine. Cysteine is required for the cellular production of glutathione, a very important antioxidant that protects the cells from free radical damage and oxidative stress. Consequently, it is interesting to note that numerous studies indicate that whey protein supplementation increases cellular glutathione levels and reduces oxidative stress (46, 47). This has been demonstrated in healthy men and women and patients suffering from various diseases (46, 47, 48). Furthermore, the lactoferrin in whey protein has been found to have anti-bacteria, antioxidant and anti-inflammatory effects (49).

There is also evidence that whey protein supplementation can help control blood pressure. Fluegel et al. (50) reported that providing 28 g of whey protein per day to young adults with elevated blood pressure significantly reduced their blood pressure over 6 weeks of treatment. Obese subjects also have been found to respond well to whey protein supplementation. Pal and Ellis (51) reported that whey protein supplementation significantly reduced blood pressure in overweight individuals after 6 weeks of treatment, and it remained lowered after 12 weeks of treatment. The blood pressure lowering effect of whey protein has been attributed to its ability to reduce the activity of angiotensin converting enzyme (52).

Another health benefit of whey protein may be its ability to help manage blood glucose. Certain amino acids such as L-leucine and L-isoleucine increase glucose transport into the cell (53, 54). Since whey protein is rich in these amino acids, it is not surprising to find that whey protein provided before or with a meal can reduce the blood glucose response in healthy individuals and type 2 diabetics (55-57)

In summary, whey protein supplementation can provide many health benefits. These range from helping control appetite, limiting muscle loss, helping to control blood pressure, combating oxidative stress, improving physical performance, limiting muscle damage due to physical activity, and enhancing exercise recovery.

### **Collagen Peptides and Whey Protein**

The proteins used in Collagen Peptides and Whey Protein are of the highest quality. Collagen Peptides and Whey Protein is gluten free and soy free. There is no added sugar in Collagen Peptides and Whey Protein making it highly keto-friendly. Furthermore, no artificial flavors or sweeteners have been added.

The collagen protein used is a hydrolysate. A protein hydrolysate is protein that has been enzymatically digested to produce small peptides or chains of amino acids. By using a protein hydrolysate, digestion of the protein and absorption of the derived amino acids are more rapid than can occur with an intact protein, thus maximizing nutrient delivery to the various tissues of the body. Our collagen hydrolysate comes from grass-fed and pasture-raised bovine, which means it is pesticide and chemical-free. It also means that the collagen hydrolysate is free of antibiotics, growth hormones and other medicines that are normally given to grain-fed factory farm cattle.

The whey protein concentrate used in Collagen Peptides and Whey Protein is derived from grass fed New Zealand whey protein. As with our collagen hydrolysate, it is free of pesticides and other chemicals normally associated with grain fed cattle. It is also free of antibiotics and other medicines. In addition, cattle that are grass fed and raised in a pasture have a high level of conjugated linoleic acid (CLA) in their milk. CLA is actually a group of fatty acids that help burn body fat. Consuming grass fed whey protein increases your bodies CLA levels, and could help eliminate some unwanted body fat.

Finally, our whey protein concentrate is produced through Cold Microfiltration Processing, which produces a non-denatured whey protein. This ensures that the protein is not lost or damaged during processing, and has superior bioavailability rich in naturally occurring immunoglobulins to support immune function.

### **Collagen Peptides and Whey Protein Servings**

There are 15 servings in each canister of Collagen Peptides and Whey Protein. Each serving is 35 g and contains 25 g of the highest quality protein available. Collagen Peptides and Whey Protein comes in either vanilla or salted caramel favor. It is recommended to take Collagen Peptides and Whey Protein in the morning when protein consumption is typically low. This will help to support tissue protein synthesis and repair throughout the day. It has also be found that increasing protein consumption in the morning hours is very satiating and helps to control snacking between meals. Collagen Peptides and Whey Protein can also be taken about 60 minutes prior to dinner to curve appetite. Dinner is typically the largest meal of the day.

### **Conclusion**

Collagen Peptides and Whey Protein can provides substantial benefits to all tissue of the body. It works synergistically to promote protein synthesis of skeletal muscle and connective tissue, the two major protein tissues in the body. The observable benefits include an improved body composition, and firmer and more youthful skin, nails and hair. The health benefits include but are not limited to reduced joint pain and inflammation, reduced risk of osteoporosis, better gut health, improved oxidative defense, better blood pressure control, and improved physical performance, and enhanced recovery from physical activity. The plethora of benefits provided by Collagen Peptides and Whey Protein are unmatched when compared to a commercially available whey protein or collagen supplement.

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