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REPORT

THE LIFE EXTENSION PROTEIN

That Fights Disease And Extends Lifespan

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Body-builders take protein powders to help them develop well-shaped, muscular bodies. Weight lifters take extra protein to help them get stronger. People who are underweight take protein to help them gain weight. And vegetarians take it to make sure they're getting enough protein for good health.

Protein is used in the production of skin, hair, muscles, and bones, and for the manufacture of hormones, enzymes, cellular messengers, nucleic acids, and immune system components. Without adequate protein, your body cannot put together the structures that make up your cells, tissues, and organs, nor can it generate the biochemical substances needed for cardiovascular function, muscle contraction, growth, and healing.



Despite the prime importance of protein for life, few scientists have looked into its role in achieving optimal health and longevity; nor have they compared the effects of different types of protein on health and longevity. *In recent years, there has been a great deal of research into the effects of vegetables, fruits and whole grains (and the nutrients in these foods) on immune function, neuroendocrine function, health maintenance, protection against disease, energy production, stamina and endurance, sexual function, and the ability to extend lifespan.*

Researching The Health Benefits Of Protein

In recent years, scientists have begun to investigate the ability of certain types of protein to improve immunity, prevent diseases, and extend lifespan. They've discovered that these proteins can have profound effects on the

metabolism of both animals and humans. In particular, they've begun to focus their attention on a particular protein found in all milks called whey, which is processed to transform it into whey protein concentrate (WPC) powder.

What Is Whey Protein?

Cow's milk contains about 6.25% protein. Of that, 80% is casein and the remaining 20% is whey. Traditionally, the term "whey protein" describes the milk proteins that remain after cheese is made from the casein in milk. whey protein is comprised of four major protein fractions and six minor protein fractions. The major protein fractions in whey are beta-lactoglobulin, alpha-lactalbumin, bovine serum albumin, and immunoglobulins. Each of these components have important disease-fighting effects.

The liquid whey protein derived from milk must go through many processing steps before it is turned into whey protein concentrate. This processing includes partial predigestion; enzyme hydrolysis; ultrafiltration and diafiltration to remove lactose (milk sugar) and fat; reverse osmosis to separate different sized molecular specks of whey; two ion-exchange processes; and high-speed air drying at low temperatures to avoid denaturing the protein components of whey. Scientists have found that only undenatured whey protein has disease-fighting benefits!

Comparing Whey To Other Proteins

Whey protein concentrate has long been a favorite of body builders because it is the **best protein for tissue repair and muscle building**. The most commonly used criterion to measure the quality of a protein is Biological Value (BV), which is the amount of nitrogen (body protein in grams) replaceable by 100 grams of protein in the adult diet. The higher the protein's BV, the higher its nitrogen retention. Proteins with the highest BV are the most potent muscle-building, growth promoting proteins. Scientists agree that the higher the BV, the better the protein is digested, utilized, and retained in the body.

Whey is a complete protein, which contains all the essential and nonessential amino acids, and boasts the **highest branched chain amino acid content found in nature**. Whey has the highest BV of any available protein. The BV of whey is 104, while the next highest BV (100) is for whole egg. In contrast, the BV of whole milk is 91, the BV of casein is 77, beef is 80, soya is 74, wheat is 54, and beans is 49. The combination of 70% whey and 30% potato has a BV 12 points higher (134) than the next highest BV combination, 60% egg and 40% soy (122).

Boosting Growth Hormone Action

Insulin-like growth factor (IGF-1) is the hormone released during growth hormone metabolism. The amount of IGF-1 produced determines the extent of the effects of growth hormone on growth in children and on the **building of muscle and lean body mass in adults**.

Studies have shown that IGF-1 rises in direct proportion to the quality and quantity of protein in the diet. Hydrolyzing whey to make di-, tri-, and oligopeptides (more short and long chain amino acids) further increases the BV of whey to 149-159, which increases the release of IGF-1, making whey the best body-building protein available by far.

Immune Power Of Whey Protein Concentrate

Whey protein appears to be unique among proteins in its ability to **improve immune function**, elevate cellular **glutathione** levels and **extend lifespan**.

Glutathione is a naturally occurring sulfur amino acid tripeptide (composed of cysteine, glutamic acid, and glycine), which is found in virtually all cells. Glutathione is a potent antioxidant and detoxifying agent that neutralizes free radical-generating hydrogen peroxide, toxic metals such as iron and aluminum, chemical carcinogens, and lipid peroxidation in cell membranes. Glutathione protects against DNA breaks caused by x-rays and sunlight and helps to maintain the oxygen-carrying capacity of red blood cells.

Glutathione Levels And Neurodegenerative Diseases

As we grow older, our supply of glutathione declines. This age related decline in glutathione has been correlated with an increasing incidence of free radical-mediated diseases such as cancer, atherosclerosis, and Alzheimer's disease.

Glutathione And Alzheimer's Disease

In one study, the brain tissue of people who died of Alzheimer's disease (a disease of accelerated aging) was shown to contain lower levels of glutathione and glutathione peroxidase, as well as higher levels of lipid peroxides than the brain tissue of elderly people who died without significant brain pathology.

The Alzheimer's patients also had adequate brain levels of vitamin E (another important lipid antioxidant), which suggests that the age-related decline in glutathione (not vitamin E may be one of the causes of Alzheimer's disease).

Alzheimer's disease has been linked to abnormally high brain levels of aluminum. When Alzheimer's patients are given metal chelators which pull aluminum from brain cells, they improve significantly and the progression of the disease is slowed. Since one of glutathione's most important functions is to eliminate toxic metals such as aluminum, it appears as if declining, age-related glutathione levels may cause a buildup of toxic metals leading to free radical activity in the oxygen-rich brain. This, in turn, leads to neurodegenerative brain diseases such as Alzheimer's disease and Parkinson's disease.

Glutathione And Parkinson's Disease

Decreased glutathione levels in brain tissue has been linked to the severity of disability in patients who died from Parkinson's disease, while no such correlation has been found for ascorbate (Vitamin C) levels. It appears as if a cell's ability to survive an oxidative assault is related to its ability to maintain its glutathione level.

One reason for the inability of vitamin C to protect the substantia nigra neurons involved in Parkinson's Disease may be that Parkinsonism is characterized by abnormally high brain levels of iron, which is reduced by vitamin-C to generate high levels of damaging free radicals. Iron may also cause brain damage by complexing with melanin (not melatonin) to form toxic hydroxyl radicals, which leads to the destruction of brain cells in the substantia nigra.

Glutathione And Atherosclerosis

Age-related declining glutathione levels have been linked to increasing risk of atherosclerosis because of

glutathione's ability to prevent the oxidation of the low-density lipoproteins (LDLs) in cholesterol. When LDLs oxidize (or become rancid), they infiltrate lesions in arterial walls, which are gradually transformed into the arterial plaques that constrict and, eventually, block blood circulation leading to heart attacks and strokes.

Glutathione And Aging

It's also been shown that the glutathione content of liver, kidney, heart, and brain was respectively 30%, 34%, 20%, and 30% lower in very old mice (31 months) than in mature mice (17-23 months). Similarly, red blood cell concentrations of glutathione peroxidase has been found to be significantly lower in elderly humans than in young adults, and glutathione levels were found to decrease substantially in the lens (of the eye) and red blood cells of aging people.

Whey increases Immune Function And Glutathione Levels

Scientists have found that decreased glutathione levels are associated with diminished immune function. In particular, they've shown that intracellular glutathione is directly related to the ability of lymphocytes to respond to mitogenic stimulation in animals (such as challenge with sheep red blood cells)— a measure of the *humoral immunity that protects us against a variety of diseases from measles and chicken pox to influenza and pneumonia*. Scientists have shown that humoral immune response, which involves the production of antibodies, requires rapid protein synthesis, which, in turn, requires an adequate dietary intake of essential amino acids (all of which are found in abundance in whey protein).

Whey Protein Research In Canada

The special ability of **whey protein to boost both immune function and glutathione levels** was discovered by Dr. Gustavo Bounous and associates at The Montreal General Research Institute and McGill University in Canada.

In the 1980s, the Canadian scientists conducted a series of experiments to evaluate how "changes in the amino acid profile of the diet can influence the immune response independently of any systemic effect on the *nutritional status of the host...i.e. how protein type could conceivably enhance the humoral immune response beyond that which has traditionally been considered 'normal'*"

Comparing Different Types Of Protein

In one study, Bounous, et al. investigated the effect on humoral immune response "of practically all the purified edible proteins commercially available at acceptable cost." They fed groups of 10 or more male 7-week-old C3H/HeJ mice a standard diet (Purina Mouse Chow), with the only variable being the type of protein included in the diet. The experimental diets all contained 20% (20g/100g) of the following types of protein: whey, casein, soy protein, wheat protein, corn protein, egg albumin, beef protein, fish protein, Spirulina maximar protein, and Scenedesmus protein.

The mice in all the experimental groups were immunized by injections of sheep red blood cells and were then tested (3-6 days later) for their humoral immune response by assaying for the ability of their spleens to produce IgM plaque forming cells – a standard measure of humoral immune response.

Results Of Study

They found that all the protein diets tested produced similar growth in the mice with comparable food intake

and serum amino acid levels. These values were similar to those found in the mice fed Purina Mouse Chow (the control group) and were well within the normal range for these animals. This finding indicates that all the varying protein diets were roughly equal in nutritional value.

However, they also found that the humoral immunity in the mice fed the whey protein diet was "substantially greater" than that of the mice fed "any other type of animal or plant protein or plain Purina Mouse Chow." The differences were all "statistically significant". For example, the mean number of plaque-forming cells per spleen five days after the injection of sheep red blood cells in the mice fed whey protein "was 487%, 494%, 736%, 927%, 309%, 284%, 288%, 274%, and 777% of that found in the casein, Spirulina, soy protein, wheat protein, Scenedesmus, corn protein, egg albumin, beef or fish protein diet-fed mice respectively, and 768% of that found in the Purina fed mice."

In reporting that **whey protein was far better in enhancing immune function than every other type of protein**, the scientists commented that they had found the same effect in three different, unrelated strains of mice, and that others had found that whey protein enhances immunity in hamsters. They concluded that:

"These related observations seen in two different mammalian species suggest the possibility that the intake of lactalbumin might produce similar effects in man. No clinical trials have been reported so far on this subject although, since the time of Hippocrates and throughout the Middle Ages, whey has been prescribed in large doses (up to 2 litres/day, i.e. 72 g whey proteins) in the treatment of numerous ailments, especially acute septic conditions."

Effect Of Whey Protein On Glutathione Levels

In another study, Dr. Bounous and his colleagues compared the effects of a whey protein rich diet on the liver and heart glutathione content and survival of old male C57BL/6NIA mice. Three groups of ten 17 month old mice were given differing diets for 3 months and were then sacrificed for analysis.

One group received a standard Purina Mouse Chow diet. The second group received a diet high in casein (20g/100g), and the third a diet high in whey protein (20g/100g).

Results Of Study

After three months, the glutathione levels were found to be higher in the liver and heart of the whey protein-fed mice compared to the casein-fed mice and Purina-fed mice. The scientists found increased liver and heart glutathione levels in the mice fed the high whey protein diet.

In another study in C3H/HeJ mice by the same scientists, it was found that a whey protein diet was significantly better than casein in raising glutathione levels in the spleen as well as the heart and liver 2-6 days after immunization with sheep red blood cells. They found that the glutathione levels in the whey protein-fed mice were up to 21% higher than in the casein-fed mice.

Whey Protein Vs. Free Cysteine

Since whey protein is rich in the amino acid cysteine, and since glutathione is manufactured in part from cysteine, it is reasonable to assume that the ability of whey protein to increase glutathione levels may be due to its cysteine content. However, when the Canadian scientists gave mice large amounts of free cysteine, they did

not see a comparable increase in glutathione levels (N-acetyl cysteine, on the other hand, is more effective in raising glutathione levels). As the scientists put it: "The efficiency of dietary cysteine in inducing supernormal glutathione levels is greater when it is delivered in whey protein than as free cysteine." It also appears that some of the other components in whey protein may help to boost glutathione levels.

Whey Protein Extends Lifespan

In the study discussed above, the Canadian scientists also looked at survival in the whey protein-fed mice (20g/100g) compared to the casein fed-mice and Purina Lab Chow-fed mice during the 6.3 month length of the study (from 21 to 27.3 months of age). They found that the mice on the high whey protein diet lived about 30% (33 days) longer than the mice on the high casein diet or the Purina diet.

Previous Lifespan Studies

In the 1980s, Diane F. Birt and associates at the Eppley Institute for Research in Cancer and Allied Diseases at the University of Nebraska Medical Center, compared the effect on the lifespan of Syrian hamsters (starting at 4 weeks of age) of three dietary levels of whey protein (10, 20, or 40% of the diet). They looked at lifespan in groups of 40 male and female hamsters (F0 generation) as well as the offspring of these hamsters (F1 generation).

The results of the study showed that the whey protein-fed hamsters lived significantly longer than animals fed a standard commercial diet to one degree or another in both the parents and offspring, depending upon the percentage of whey protein in the diet. *There were no significant differences in growth and weight (compared to controls) in the hamsters given large amounts of whey protein.*

The greatest increase in lifespan was seen in the male hamsters on the 20% whey protein diet. The last surviving control animal died at 88 weeks of age compared to 140 weeks of age in the whey protein-fed hamsters – an extension in maximum lifespan of about 60%! *The fact that the longest surviving whey protein-fed hamster lived almost three years (about the upper lifespan limit for Syrian hamsters), while none of the hamsters fed the commercial diet reached two years of age, suggests that supplementation with whey protein may have an anti-aging effect.*

In another study of lifespan in Syrian hamsters by the same group, a significant survival advantage (over a 20 week period) was shown in animals receiving three levels of whey protein supplementation, with the hamsters receiving the 20% whey diet surviving the longest.

Whey Protein Inhibits Malignant Tumors In Mice

In 1988, Dr. Bounous and his colleagues looked at the effects of 20% whey protein and 20% casein diets on humoral immunity and malignant tumor development and growth in A/J mice exposed to the chemical carcinogen dimethylhydrazine.

After 20 weeks of carcinogen exposure, the ability of the whey protein fed mice to generate plaque-forming cells in their spleens was three times greater than in the casein-fed mice, although both values were below normal.

After 24 weeks of carcinogen exposure, the incidence of malignant tumors in the whey protein-fed mice was

substantially lower than that in mice fed either the casein or Purina diets. In addition, the average tumor size was smaller in the whey protein group than in the casein and control groups. (Body weight was similar in all three groups).

Whey Protein Fights Infections

Whey protein has also been found to be highly effective against microbial infections such as salmonella, streptococcus pneumonia, and other microbial challenges. Whey protein appears to be effective in increasing cellular immune response as well as humoral response.

Improvement In HIV-Positive Patients

Because of the muscle-building immune-enhancing effects of whey protein that have been demonstrated in both human and animal studies, Dr. Bounous and his colleagues decided to replace much of the protein intake in three HIV-positive patients with the undenatured whey protein they had developed.

The three HIV-positive patients took whey protein powder dissolved in the cold drink of their choice in quantities that were increased progressively from 8.4 to 39.2 grams per day over a 3-month period. The patients experienced no adverse side effects from the whey protein.

All three patients gained between 2 and 7 kilograms progressively, with two of them reaching their ideal body weight before the end of the study. Their serum protein levels remained unchanged during this period, indicating that protein replenishment per se was not responsible for their increased body weight.

The glutathione levels of their blood mononuclear cells had been below normal in all three patients at the beginning of the study. After three months of whey protein supplementation, however, glutathione levels increased in all three patients. In one patient, glutathione levels rose by 70% to reach a normal level!

These objective changes in weight gain and higher glutathione levels were accompanied by a marked improvement in their sense of well-being in all three patients!

Why Whey Protein Must Not Be Denatured

The Canadian scientists have discovered that the immune-enhancing, glutathione - boosting powers of whey protein requires that its protein components remain stable and structurally sound. In their natural state in milk, whey proteins have a definite native configuration, which is changed in shape (or "denatured") by the destruction of disulfide bonds when exposed to heat above a certain level such as during pasteurization. In addition to the perils of heating, there are other processing steps that promote denaturation, including pumping, mixing, aeration, vacuum evaporation, and spray drying.

A good sample of denaturation is what happens to the white part of a raw egg when it is cooked. When raw, the white part of the egg can be dissolved in water, but after it is cooked, the protein in the egg white becomes hard and insoluble.

The Canadian scientists believe that the glutathione- and immune-boosting activity of whey protein depends largely upon glutamylcysteine peptides contained in its serum albumin fractions, in the betalactoglobulin, and

possibly in the immunoglobulin G fraction. They believe it is critically important to preserve the structure of these glutamylcysteine peptides in order to maintain the integrity of the protein. If the glutamylcysteine peptides unfold, they expose it to digestive enzymes which destroy its integrity and rob it of its health-building properties.

Health Benefits Of Undenatured Whey Protein

Dr. Bounous and his team believe their research into the effects of undenatured whey protein holds great promise for the prevention and treatment of a wide variety of conditions. As they put it:

"This discovery could provide a method for efficiently increasing cellular glutathione levels for any purposes for which elevated glutathione levels are desired, such as for drug detoxification, arteriosclerosis, Alzheimer's disease and Parkinson's disease; cellular protection against oxygen and its metabolites such as peroxides, free radicals or foreign compounds, carcinogens, irradiation, and immunodeficiency states."

For more on Whey Protein see the November 1997 article:

Fighting Cancer With Whey

About the Author:

Will Brink is a contributing consultant, columnist, and writer for MuscleMag International. He has been published in over thirteen countries on various topics relating to bodybuilding and health and fitness. He has a degree from Keene State College and is currently finishing a degree with a concentration in natural sciences and a minor in chemistry at Harvard University. He is a well known trainer who has worked with many high level athletes ranging from professional bodybuilders, fitness contestants, Olympic hammer throwers, to professional golfers. He is a consultant to several supplement companies and a judge for the National Physique Committee (NPC) and Ms. Fitness USA.

Will has lectured on the benefits of weight training and sports nutrition at conventions in New York, Los Angeles, and the Metro Sport convention in Boston. In addition to his own writing, he has co-authored articles with several notable scientists, such as Dr. Udo Erasmus, Dallas Clouatre Ph.D., and Edwin Worthy B.Sc., M.D., on various subjects relating to health and fitness. Through Brink Training Systems (BTS), he continues to assist many of the country's top athletes through seminars, phone consultation, and writing in MuscleMag International and other related health and bodybuilding publications.

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