

Ageing Gracefully

Not only sports performance, but also ageing and physical fitness during the ‘Golden Years’, has prompted much interest in creatine lately.

by Henk Hoogenkamp

Rising health care costs will put significant pressure on health care management. Affluent consumers are therefore expected to purchase foods and services that deliver preventive solutions rather than wait for the inevitable and respond to diagnosed maladies in an effort to improve their quality of life. Put in a different way, life expectancy increase has changed socio-economic parameters, not least the desire of longevity without morbidity.

It is a small but significant step to translate reactive health to proactive health. Foods and beverages containing bioactive components that impart health benefits beyond basic nutrition can be seen as foods and beverages with a health bonus. The purported benefits are improved and enhanced physical or emotional health.

Painless Health

It is clear that the quest of people in the Western world has changed from surviving to managing health. Active seniors – people 55 years and over – have a strong desire to live long and prosper. Quite often these are conflicting goals as life span increases. There is little doubt that longevity is accounted for by

better nutrition, hygiene and managed healthcare. The key question about ageing populations is to find an answer if they will live older and healthier, or will longer years of life be accompanied by more years of disability? Growing old healthy is the paradigm of the future and for the food and beverage industry this means assessing the need to develop products which are easy to use and assist in both preventive and curative support because of proven therapeutic properties.

Since people are increasingly looking for painless ways to make diets healthier, beverages are ideal vehicles to deliver premium nutrition. For example, such a beverage can be packed with compounds such as premium proteins, prebiotics and creatine to boost health, including avoidance or slowing down of degenerative muscle disease. In other words; actively improving the quality of life, while increasing the quantity of life. Together with protein supplementation, creatine is likely to be one of the most used sports supplements of all time.

What is Creatine?

Simply said: creatine works to help generate energy. Creatine is a non-essential compound

that can be obtained in the diet or synthesised by the liver, pancreas, and the kidneys. Approximately 95% of the body’s creatine is stored in the skeletal muscle, where its primary function is as an energy buffer.

Creatine is formed in the human body from the amino acids methionine, glycine and arginine. The average person’s body contains approximately 120 grams of creatine stored as creatine phosphate. Certain foods such as meat and fish are fairly high in creatine. However, a person would have to eat kilos of these foods on a daily basis to equal what can be obtained in one teaspoon of creatine. For example, approximately 4.5 grams of creatine is present in 1 kilo of lean beef. As creatine is severely restricted in plant or vegetable foods, creatine supplementation may be especially beneficial for vegetarians. This also appears to be the case for ageing people or elderly who have a gradual decline of appetite and thus food intake.

Once in the body, creatine is carried in the blood to skeletal muscles, the heart, and the brain. Creatine enters muscle through a specific sodium transporter protein. Ingestion of creatine supplements produces an increase of muscle creatine and phosphocreatine levels, although there is a large inter-subject variability in the responses. One factor contributing to the variability is the baseline muscle creatine level, such that a high existing level is associated with a smaller

increase in muscle creatine of supplementation.

Elevated muscle phosphocreatine could potentially benefit short high-intensity exercise by providing a greater capacity to regenerate adenosine triphosphate (ATP) and a buffering of hydrogen ions. Thus, creatine is directly related to ATP, which is formed in the mitochondria. The ability of a cell to do work is directly related to its ATP-status and the health of the mitochondria.

Demanding Times

During times of increased energy demand, phosphocreatine (PCr) donates its phosphate to adenosine diphosphate (ADP) to produce adenosine triphosphate (ATP). When ATP loses a phosphate molecule and becomes ADP, it must be converted back to ATP to produce energy. When ATP is depleted it can be recharged by creatine phosphate. That is to say, creatine phosphate ‘donates’ a phosphate molecule to the ADP, making it ATP again. Intense efforts of physical activity rely heavily on the ATP-PCr energy system. It is the only fuel system in the muscles that can produce energy at sufficiently high rates to accomplish these tasks, albeit only for a brief period of time before PCr stores are depleted.

Creatine uptake in muscle cells is associated with water accumulation in cells, which could create muscle swelling, making muscles appear larger. Although the increase in cellu-



Xtreme Vitamin & Mineral Chocolate Mint Flavoured Bar launched in Canada contains 5 grams of creatine.

lar hydration has been suggested to stimulate protein synthesis or reduce protein degradation, this has not been proven.

Side effects of creatine supplements have been few and mild. Creatine supplementation does not appear to result in a greater incidence of cramps, heat-related injuries and stomach upsets. Furthermore, one study showed that up to 21 months of supplementation was not associated with changes in blood and urine markers of liver and kidney function in healthy people. To date only three meta-analysis articles on the effectiveness of creatine have been published, with equivocal results.

Sports Reflection

The consumption of oral creatine monohydrate has actually become increasingly common among amateur as well as professional athletes. Exogenous creatine supplements are often consumed by athletes in amounts of up to 20 gram per day for a few days, followed by a maintenance phase of 3 to 10 grams per day. This regimen continues for weeks, months and even years.

Interest in the effects of creatine use by athletes has led to numerous studies. Many of these studies have produced conflicting findings. However, the American College of Sports Medicine (ACSM) has published a consensus statement in the March 2000 issue of *Medicine & Science in Sports & Exercise*. The statement includes findings that show creatine use enhances exercise performance involving short periods of extremely powerful anaerobic activity and strength gains during strength training programmes.

The use of creatine does not enhance aerobic exercise performance or increasing maximal isometric strength. The ACSM-panel further stated that a dosage of 20 gram per day is unnecessary; 3 gram per day will achieve the same increase in phosphocreatine given time.

Also, within the first few days, use of creatine can lead to weight gain, likely caused by water retention related to creatine uptake in the muscle. The panel found that changes in the muscle with the use of creatine do not mimic adaptive changes; therefore, creatine use cannot replace weight training. Finally, panel members agreed that there is no definitive evidence that creatine supplementation causes gastrointestinal discomfort, and renal or muscle cramping complications. Creatine should not be used immediately before exercise, and should not be used by children or by women who are pregnant or lactating.

Taking Creatine Further

Starting at about 50 years of age, people begin to lose 12 percent of the muscle strength and 6 percent of the muscle mass every 10 years. Proper nutrition, the use of creatine supplements and exercise/weight training can reverse this.

Not only sports performance, but also ageing and physical fitness during the 'Golden Years', has prompted much interest lately. It has been hypothesised that people who increase creatine levels by ingesting creatine supplements have a greater energy reserve available to support brief and intense efforts of physical fitness. Creatine monohydrate is over 90% absorbable and besides sports science studies the more interesting and promising creatine research focuses on the following fields:

- Creatine and neuromuscular diseases.
- Creatine and neurological protection (brain injury).
- Creatine and heart disease.

Recently however, medical researchers and physicians have also started to focus on creatine to treat the ageing and ill with diseases that cause muscle weakness and atrophy. One of the most debilitating symptoms of ageing is the loss of muscle

strength and consequently, independence. An inability to climb stairs or to walk even a short distance without resting can make independent living impossible, not to speak of enjoyment of the ageing years.

Neuromuscular Diseases

One cause of this muscle degeneration is a reduced level of creatine in ageing muscles – the same characteristics found in younger patients with neuromuscular diseases such as muscular dystrophy.

Under the leadership of Dr. Mark Tarnopolsky MD, at the McMaster University Medical Center in Hamilton, Ontario, positive results were found on 81 patients with neuromuscular diseases after a 10-day regimen of creatine in powder form. In the study, the patients were tested at the beginning and end of the 10-day period to measure strength gains. On average, the patients exhibited improvements of 10 to 15% in hand, fist and leg strength. Along with the muscle strength, these patients also experienced weight gains and an increase in lean muscle mass.

Energy Molecule

It therefore is quite logical that creatine often is referred to as the 'universal energy molecule' used by every cell of our bodies. An increase in oxidative stress coupled with a cell's inability to produce essential energy molecules such as ATP, is a hallmark of the ageing cell and is found in many disease stages.

Key factors in maintaining health are the ability to:

- Prevent mitochondria damage to DNA caused by reactive oxygen species.
- Prevent decline in ATP synthesis which reduces whole body ATP levels.

It would appear that maintaining antioxidant status (in particular intra-cellular glutathione) and ATP levels are essential in fighting the ageing process. Creatine's function can

be summed up as 'giving one bridge between one energy source and the other allowing for higher energy output over a longer period of time'.

Packaging Creatine

There appears to be approximately a 30% increase in creatine absorption when it is taken with carbohydrate to optimise slow-down of muscle degeneration. It is suggested to supplement the ageing body by 3 grammes per day. Creatine is most effective when consumed as a beverage which also may contain premium protein ingredients such as whey protein isolate, soy protein isolate, or high glutamine wheat protein isolate (Gempro HiQ) together with sufficient amounts of carbohydrates such as glucose in order to maintain electrolyte balances. In such a concept it is essential that creatine remains protected from light and moisture and stored in a sealed container.

Alko Research BV in The Netherlands has for example pioneered a system, which allows fully automatic release of creatine by means of a patented dispersing mechanism. This mechanism – when triggered by a pull-tab – will release the stable creatine within seconds in the ready-to-drink beverage. ♦

A full list of references for this article can be found at www.foodingredientsfirst.com

Note: Creatine has not been evaluated by the FDA for safety, effectiveness or purity. There are no regulated manufacturing standards in place for creatine compounds. It is essential to implement quality control & protocol standards to minimise the risk of contamination. 100% pure creatine monohydrate should be used. For reference see analysis report of the IOC laboratory in Gent Belgium, batchnummer 036202/FSKK159. Interaction between creatine and other prescription or over-the-counter medicines or herbal and health supplements have not been reported. Theoretically, creatine and other medicines that affect the kidneys may interact.