



**PHYTONUTRIENTS**  
FOR ATHLETIC  
PERFORMANCE



# Introduction

A crucial goal of sport nutrition for athletes is to modify nutritional stressors associated with muscle damage and repair from intense training and competition schedules. Dietary strategies, which enhance recovery from the negative effects of exercise, can help promote more effective physiological adaptations, muscle reconditioning after exercise and enable a faster return to training. This goal will never change. It will stay until the end of sport. It is thus vital for researchers to spend time finding the newest cure for athletic recovery and it is vital for athletes not to be ignorant and not use the latest research in their favour.

One of the latest trends in sport nutrition is phytonutrients. Phytonutrients were on the scene a few years ago, but faded quickly due to a lack of research and implement ability. Now, dietary supplement companies are coming on board in the field of phytonutrients and athletes are reaping the fruits.





## What are phytonutrients?

Phytonutrients are compounds which are found in plants, which give plants their unique taste and aroma. More importantly, phytonutrients also strengthen a plant's immune system. They protect a plant from threats in their natural environment such as disease and excessive sun. Phytonutrients are non-nutritive and non-essential nutrients (which means they are not needed by the body to sustain life). Phytonutrients protect humans against disease.

What does this have to do with athletes? Well, when athletes eat a variety of fruit and vegetables, they consume a multitude of phytonutrients without actually knowing it. Phytonutrients have a protective and restorative function in athletes' bodies. They can protect humans against chronic diseases, it has potent anti-cancer and anti-heart disease effects. In addition, it has been seen that these phytonutrients are potent for athlete performance and especially athletic recovery after intense training sessions.

There was a day when the term 'antioxidants' was unfamiliar to athletes. Today, antioxidants are on the tongues of most athletes, especially

professional athletes that are looking into the benefits of natural foods. Although athletes might not have heard so much about phytochemicals or the more consumer-friendly term phytonutrients, it is making a big step in the right direction. Although athletes might not be familiar with the word phytonutrients, they most definitely are familiar with the value of plant-based foods (such as fruit and vegetables) in not only providing vitamins and minerals, but by providing nutritional value.

Recent studies have confirmed that a higher consumption of fruit and vegetables was significantly associated with a lower risk of all-cause mortality. The question is, how many fruits and vegetables per day. Science is still arguing about this. The other issue is fresh vs frozen vs 'a few days old'. Which provides the most amount of phytonutrients? In addition to this, scientists are only now discovering the tip of the iceberg when it comes to phytonutrients – they are only now discovering the more than

25 000 phytonutrients' functions in our bodies and more importantly what these can do to improve an athlete's performance and their session-to-session recovery.





## EFFECTS OF PHYTONUTRIENTS ON THE BODY

Like macronutrients are needed for building strong bodies and providing energy and vitamins and minerals needed for proper functioning of intricate systems, phytonutrients play an essential role in maintaining health and preventing disease. There are 9 essential functions of phytonutrients:

- 1. Phytonutrients act as antioxidants** – in other words they act as scavengers for free radicals which are produced in the body during normal metabolism as well as during exercise. If free radicals are not cleared up they can damage the body's DNA and other cellular components. Antioxidants neutralize these free radicals, preventing their damage
- 2. Phytonutrients have an anti-inflammatory effect** – while inflammation is natural in the body's response to damage and exercise, chronic inflammation has been linked with numerous medical conditions from connective tissue diseases to cancer
- 3. Phytonutrients enhance immunity** – some act as anti-microbial agents which reduce the chance that harmful bacteria or viruses will divide and grow in the body. They also help to modulate the immune system by helping to maintain the delicate balance between an overactive and underactive immune system. An overactive immune system can lead to autoimmune diseases where an underactive immune
- 4. Phytonutrients have neuroprotective effects** – evidence suggests that phytonutrients can have a positive effect in people suffering from Alzheimer's and Parkinson's disease
- 5. Phytonutrients can block the formation of carcinogens** – there are some phytonutrients which can prevent substances in food or the environment from becoming carcinogens (cancer-causing agents)
- 6. Phytonutrients have with anti-cancer effects** – it has been seen that certain phytonutrients can help in DNA repair by repairing mutated genes that lead to cancer. It slows the growth of tumours and facilitates the process where abnormal cells are killed (apoptosis)
- 7. Phytonutrients regulate hormones** – an example of this would be isoflavones (soy) and lignans found in flax. They can mimic estrogen in the body and in many cases block estrogen receptor sites, diminishing estrogen's effects on certain tissues. Some phytonutrients also have an effect on insulin such as resveratrol, lycopene and quercetin.
- 8. Phytonutrients have anti-ageing effects** – phytonutrients such as resveratrol, epicatechin, quercetin, curcumin and allicin have shown anti-ageing effects
- 9. Phytonutrients are used to treat disease** – research is still in the beginning phases, but it seems that phytonutrients can not just be used to maintain health or prevent disease, but also treat disease. Research has already found that some phytonutrients may help fight cancer – e.g. phloretin (pears), EGCG in green tea as well as quercetin. Other foods which are known to fight heart disease are flavonoids in berries. Newest research is looking into the ability of phytonutrients to sensitize breast cancer cells to treatment.



## PHYTONUTRIENT CATEGORIES

There are 3 broad categories that have emerged out of research of these 25 000 phytonutrients and they have been grouped into main areas:

**Thiols** – these are sulphur-containing compounds such as glucosinolates. **These protect cells from oxidative damage**

**Phenols** – includes the broad category of flavonoids with tannins and isoflavones as subsets. **Protects against oxidative damage and inflammation**

**Terpenes** – includes the broad category of carotenoids with alpha-carotene, beta-carotene,

lutein and lycopene as subsets. **Provides anti-cancer and cardiovascular-health properties**

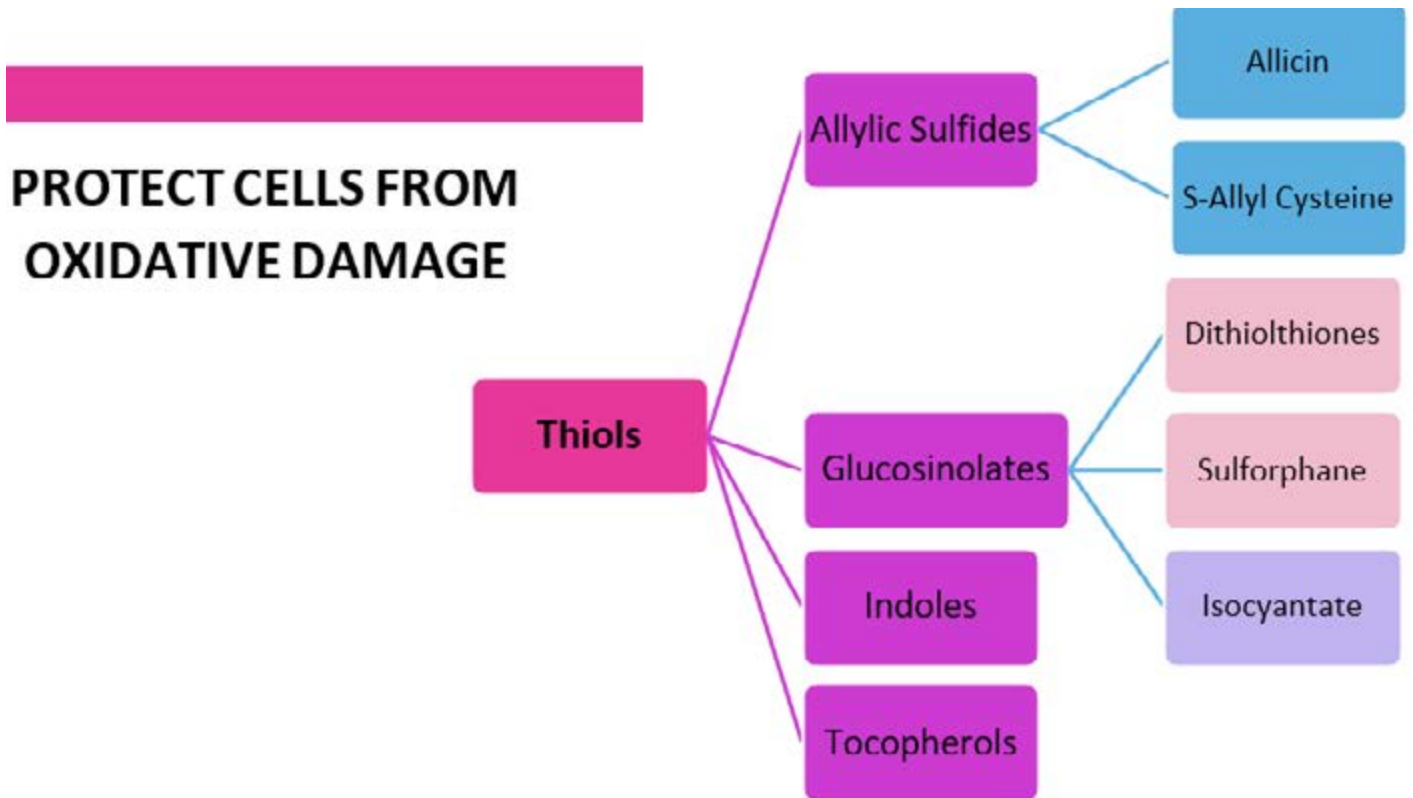


Figure 1: Group 1 – Thiols – known to protect cells against oxidative damage



## PROTECT AGAINST OXIDATIVE DAMAGE & INFLAMMATION

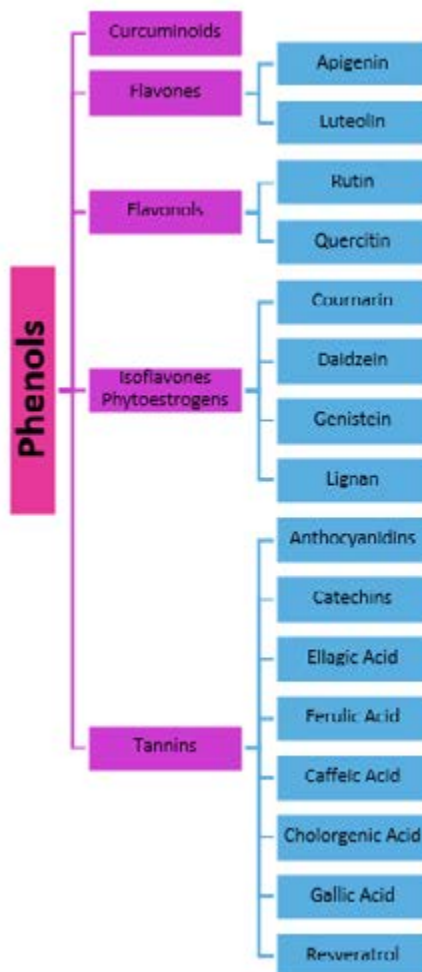


Figure 2: Group 2 – Phenols – known to protect against oxidative damage and inflammation

## PROVIDE ANTI-CANCER AND CARDIOVASCULAR-HEALTH PROPERTIES

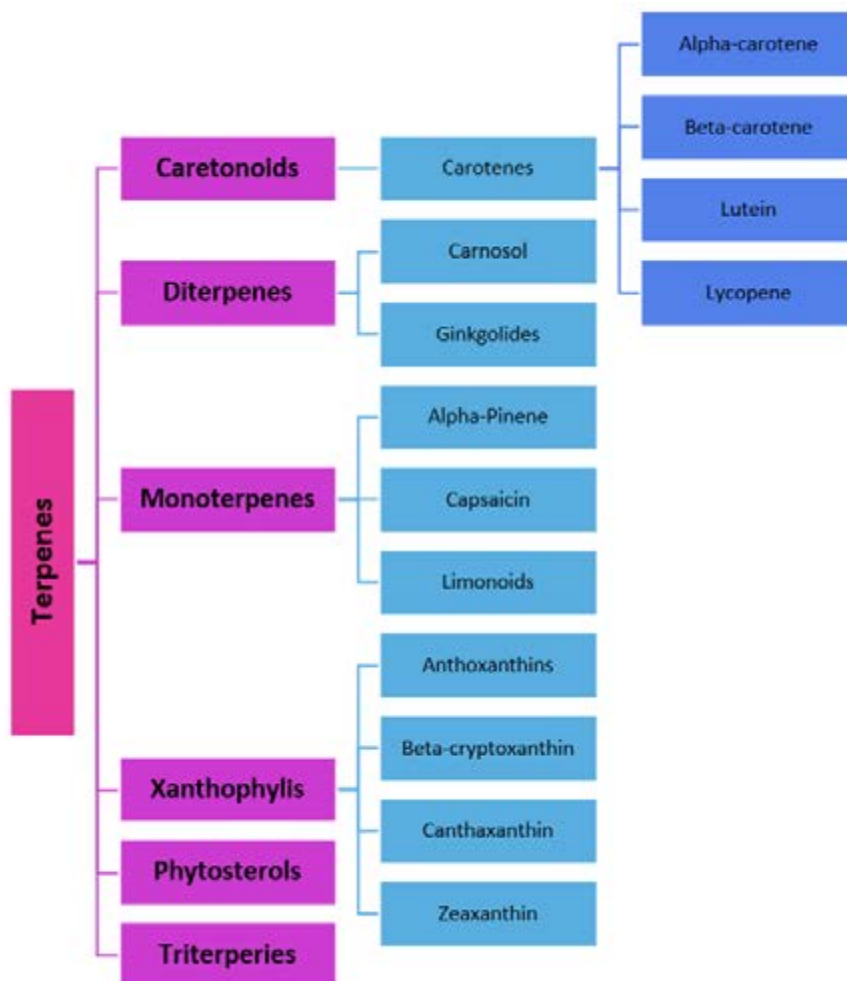


Figure 3: Group 3 – Terpenes – known to provide anti-cancer and cardiovascular health properties



## COLOURS OF THE RAINBOW:

Eating a variety of fruit and vegetables have been with the human race for as long as one can remember. Yet, we are so often neglecting this 'old piece of advice'. Athletes would rather seek the latest innovation in sport nutrition and non-athletes are just ignorant and often opt for the quickest form of food, which is 90% of the time bland and lacking in colour. Let's have a look at the good old rainbow technique of eating food.

## 1. Red

- Phytonutrients: Carotenoids, lycopene, ellagic acid, quecetin, hesperidin, anthocyanidins
- Forms part of groups Phenols as well as Terpenes
- **Lycopene is a potent scavenger of gene-damaging free radicals to protect against cancers, heart and lung disease**
- **Terpenes provide anti-cancer and cardiovascular-health properties**
- **Phenols protect against oxidative damage and inflammation**
- **Supports prostate, urinary tract and DNA health. Protective effect against cancer and heart disease. In addition red foods are immune modulators.**
- Found in: strawberries, cranberries, raspberries, tomatoes, cherries, apples, beets, watermelon, red grapes, red peppers, red onions, pomegranate, red cabbage, radishes, guava, pink grapefruit, cayenne pepper





## 2. Orange and yellow

- Phytonutrients: alpha-carotene, beta-carotene, beta-cryptoxanthin, zeaxanthin, hesperidin, lutein
- Forms part of the group Terpenes
- **Beta-cryptoxanthin supports intracellular communication and may help prevent heart disease**
- **Terpenes provide anti-cancer and cardiovascular-health properties**
- **Supports eye health, healthy immune function, skin hydration, overall growth and development**
- **It is also an antioxidant for fat-soluble tissues and assists with endocrine modulation**
- **Orange foods also play a role in ovulation and fertility processes**
- Found in: yellow grapefruit, cantaloupe, papaya, squash, corn, turmeric, carrots, sweet potatoes, yellow peppers, oranges, bananas, pineapple, tangerines, mango, pumpkin, apricots, butternut, peaches





### 3. Green

Phytonutrients: Lutein, zeaxanthin, isoflavones, EGCG, indoles, isothiocyanates, sulphoraphane

Falls under the groups Thiols, Phenols and Terpenes

This means that green foods form part of all 3 classification groups of phytochemicals

- **It inhibits the action of carcinogens (cancer-causing compounds)**
- **Protects cells from oxidative damage (beneficial for athletes)**
- **It supports eye health, arterial function, lung health and healthy liver function**
- **In addition it protects against inflammation as well as provide cardiovascular-health properties**
- Found in: kale, parsley, spinach, avocados, asparagus, artichokes, broccoli, alfalfa sprouts, kale, cabbage, Brussels sprouts, kiwi fruit, collard greens, green tea, green herbs (mint, rosemary, sage, thyme, basil, oregano)



### 4. Blue and purple

- Phytonutrients: resveratrol, anthocyanidins, phenolics, flavonoids
- **Delay cellular aging and help the heart by blocking the formation of blood clots**
- **Protects against oxidative damage and inflammation (beneficial for athletes)**
- **Phytonutrients in pomegranates have been found to prevent the loss of strength associated with inflammation**
- **Anthocyanidins which are found in tart cherries may suppress the enzymes that cause inflammation in the first place**
- **Quercetin which is found in apples, onions and potato skins, which is also a phenol, works to support the athlete's immune system, which is often compromised during periods of intense training**
- **In addition blue and purple foods supports cognitive function, enhances a healthy balance of mood and plays a role in neuronal health.**
- Found in: acai berries, purple grapes, blueberries, blackberries, elderberries, concord grapes, raisins, eggplant, plums, figs, prunes, lavender, purple cabbage



## 5. White and brown

- Phytonutrients: EGCG, allicin, quercetin, indoles, glucosinolates
- Falls under the groups Thiols as well as Phenols
- **It has anti-tumor properties whilst acting as antioxidants to protect against oxidative damage and inflammation**
- **It supports healthy bones, circulatory health, support arterial function**
- Found in: onions, cauliflower, garlic, leeks, parsnips, daikon radish, mushrooms, turnips, horseradish, white kidney beans, pears, apples, ginger, cocoa







## WHAT DOES THE RESEARCH SAY?

**Exercise Induced Muscle Damage (EIMD)** is a temporary phenomenon caused by unaccustomed, damaging exercise and is most often characterized by structural

damage to myofibers as well as secondary inflammation which results from leukocyte infiltration into damaged tissues (muscles). The signs and symptoms of EIMD can start immediately after a training session and can persist for several days. However, if there is a latent period of no soreness after a training session and then after 24-48 hrs soreness starts and only dissipate after 3 days, it is known as Delayed Onset of Muscular Soreness (DOMS). EIMD typically include muscle soreness, decreased pressure pain threshold, localized swelling, temporary decrements in max force generating capacity as well as elevated levels of: creatine kinase (CK), lactate dehydrogenase (LDH) and myoglobin (MYO). In addition EIMD often times results in elevations of C-reactive protein (CRP) which is an indicator of inflammation of the body.

Although it is sought after to decrease these debilitating effects after a training session, you have to ask yourself the question of why it is happening in the first place. What is the use of EIMD? It is a key part of the adaptive remodelling process, in other words, the ability of the muscle to become stronger, faster or endure more. However, should EIMD take longer than 48 hrs for particular athletes, it will influence their training programme and ultimately their progress in terms of conditioning and skill development. The ideal balance is thus to allow soreness to happen but to speed up the process so that it does not hamper the athlete for too long. Science has specifically looked into the use of antioxidants and phytochemicals to help protect against oxidative stress of hard training, reduce inflammation and enable athletes to recover quicker and have a faster return to training.

### THE PHYTONUTRIENT GAP

Despite all the knowledge out there about the benefits of fruit and vegetables, most people ignore these benefits and consume about a third of what is needed every day. In the USA, 75-80% of adults do not meet the WHO recommended minimum 5 servings per day. 69% of adults fall short in eating from the green group; 78% from the red group, 86% from the white group, 88% from the purple group and 79% from the yellow/orange group. Eating the recommended quantity of fruit and vegetables as well as the variety is challenging for many regions in the world. There are specific obstacles that could affect consumption, such as busy lifestyles, availability of a variety of fruit and veg, the cost involved in eating a rainbow plate etc. Many people are aware that fruits and vegetables are packed with vitamins and minerals and are high in fibre, but it is often neglected that these contain phytonutrients which could fight disease and assist athletes with performance benefits.





# PHYTONUTRIENTS & SPORT PERFORMANCE

Science has shown in recent years that there are positive benefits for phytochemicals with anti-inflammatory and antioxidant effects for athletes, particularly **flavonoids**.

**Anthocyanins** (part of sub-group Tannins and the group Phenols) – which are known to protect against oxidative damage and inflammation – found in blue, purple and red foods, e.g. tart cherry juice, berries, grapes

Studies conducted with **tart cherry juice** in particular has shown minimal strength losses during eccentric training sessions if consumed prior to training. In addition it has shown a considerable reduction in muscle soreness, recovery of force production and recovery after marathon running / endurance training.

Science also looked at the effects of **quercetin** which showed potential benefits for its use during recovery in reducing post-exercise inflammation.

In a study done at the University of Texas, participants who drank **pomegranate juice** prior to exercise experienced 25% less soreness 2 hours after training. In addition the study also showed a 10% increase in strength 2 days after consumption.

In addition to phytonutrients fighting inflammation and oxidative stress, scientists are discovering that phytonutrients can also have an effect on:

The **genetic matrix** of a person, by turning genes on and off in an attempt to **protect us against us against disease development**.

Phytonutrients have a **massive influence on the immune system**, which is of critical value for athletes that train multiple hours per day and can easily overtrain if not managed correctly. Many athletes often train hard for a couple of weeks and then suddenly get sick – this usually occurs because the immune system of the body is under stress and the nutritional intake is insufficient. This is where phytonutrients can make an immense impact.







**Phytonutrients can act as prebiotics**, which stimulates the growth of bacteria in your gut and in effect boosts the immune system. Remember the immune system is as strong as the gut is healthy. If the gut is unhealthy, the immune system is weak and open for infections. If you look specifically at green tea, which is a polyphenol, it acts as a prebiotic and can alter the balance of the intestinal flora by inhibiting the growth of 'bad bacteria' and stimulates the growth of 'good bacteria'.

Science is not only looking at the immune stimulating effects and inflammation-fighting properties of phytonutrients. Phytonutrients are also known for their ability to boost mental

clarity and focus. Scientists are using this to enable athletes to focus more intensely and for longer periods of times during training and competitions. Athletes are eager to see the research conducted in this area. We already know that **resveratrol** which is found in chocolate and red wine (which is a tannin, subgroup flavonoids, group phenols) can enhance **memory retention and neural communication**. There are also flavonoids which exhibit neuroprotective properties.

"In all likelihood, every single plant has benefits – both for general health and athletic performance" Dr Kleiner, author of ***The Powerfood Nutrition Plan.***



## THE FUTURE OF PHYTONUTRIENTS

There are a multitude of phytonutrients which are making headway in terms of providing all the benefits of phytonutrients. Unfortunately there are not much research-based articles on many of these ingredients yet. It is assumed that research in this area will improve in the next couple of years. However, athletes are always known for pushing the boundaries and often experiment with certain nutritional compounds to see their effect on training and performance.

### Let's have a look at some of the phytonutrients making a leap into the future:

<b>Red Superfoods</b>	<b>Goji berry extract</b>	<p>Rich in zeaxanthin and lutein (terpenes)            They provide anti-cancer and cardiovascular benefits            It boosts the immune system as they are high in Vitamin A,C and antioxidants            It stabilizes blood sugar levels – this is essential for all athletes            It can improve depression, anxiety and sleep            It is used to treat liver disease            Excellent for eye health            Note: should not be taken by people on blood thinners, blood pressure medication and diabetes medication</p>
	<b>Pomegranate</b>	<p>Rich source of ellagitannins (phenols)            Chronic supplementation with pomegranate juice may improve functional measures and reduce biomarkers of EIMD            It is a high in anti-oxidants and anti-inflammatory properties            Studies show 750ml / day and 500ml 1 hour before exercise shows decreased soreness 48 hrs after exercise and showed lower levels of post-exercise CK and LDH levels</p>
	<b>Tart Cherry Juice</b>	<p>Tart cherries are rich in anthocyanins            Chronic supplementation of tart cherry juice effectively modulate the symptoms of EIMD            60ml tart cherry concentrate per day for 10 days in trained athletes increased the rate of isometric force recovery at 80% 1RM            Chronic supplementation with tart cherry concentrate of about 60ml /day or 500ml juice per day improve decrements in muscle function, reduce markers of EIMD and decrease perceptions of pain immediately after and during 48hrs of recovery after intermittent or endurance exercise</p>
	<b>Red Beetroot Powder</b>	<p>Rich in carotenoids, flavonoids and phenols in addition to Vitamin C            Rich in nitrites, which is converted into nitric oxide when it is consumed – this improves lung function, blood flow and muscle contractions            Nitric oxide is a vasodilator, which means better blood flow to muscles. This will allow more oxygen to travel to muscles during endurance exercise. In addition it will improve waste product clearance rates            It improves reaction time especially in between high intensity sets / short, high intensity sports</p>
<b>Orange and Yellow Superfoods</b>	<b>Curcumin</b>	<p>It is a curcuminoid which is part of phenols            It protects against oxidative damage and inflammation            Known as turmeric (see previous FSSSI article)            Enhances exercise performance through improved cardiovascular function, modulation of serotonin neurotransmitters as well as the modulation of exercise-induced inflammation and damage            Acts as an antidepressant            Assists female athletes by decreasing the intensity and pain associated with menstrual cycles</p>





	<b>Ginger Extract</b>	<p>It is rich in flavonoids</p> <p>It protects against oxidative damage and inflammation</p> <p>It aids in digestion, stomach pains, cramps and gas</p> <p>It helps with menstrual pain</p> <p>Can assist with detoxification of the body</p> <p>Assist in reducing muscle soreness</p> <p>Increases energy and reduces the rate of fat formation (lipidogenesis)</p>
	<b>Beta-carotene</b>	<p>Rich in carotenoids</p> <p>Found in yellow vegetables &amp; fruits mostly</p> <p>High in Vitamin A</p> <p>Essential for skin and eye health</p> <p>Vit A and carotenoids are essential for a good immune system</p> <p>It plays a role in iron metabolism – it prevents a decrease of serum iron and the iron saturation index. There is a link between iron metabolism and oxidative stress. Hence antioxidants like beta-carotene can assist in iron metabolism</p>
	<b>Lutein</b>	<p>Rich in carotenoids, similar to beta-carotene</p> <p>It has powerful anti-inflammatory properties</p> <p>It is essential for eye health of athletes</p> <p>It is regarded as a supplement which 'should be taken every day'</p> <p>Found mainly in dark, leafy green vegetables, eggs and oranges</p> <p>It assists with cardiovascular, cognitive, skin and eye health of the athlete</p>
<b>Green Superfoods</b>	<b>Moringa</b>	<p>Moringa is high in a multitude of phytonutrients: tannins, sterols, terpenoids, flavonoids, saponins, anthraquinones and alkaloids with special mention of its quercetin and kaempferol quantities</p> <p>One of the most versatile superfood. It is able to treat a multitude of conditions such as:</p> <ul style="list-style-type: none"> <li>Asthma</li> <li>Hyperglycemia</li> <li>Flu</li> <li>Heartburn</li> <li>Malaria</li> <li>Pneumonia</li> <li>Diarrhea</li> <li>Headaches</li> <li>Skin diseases</li> <li>Bronchitis</li> <li>Eye &amp; ear infections</li> </ul> <p>Reducing high blood pressure &amp; cholesterol</p> <p>Acts as an anti-cancer, anti-diabetic and anti-atherosclerotic neuroprotection agent</p> <p>Aids in weight management of weight division athletes</p> <p>Moringa is able to increase testosterone levels in individuals with decreased levels, but no research indicates that it will be beneficial for athletes to boost their testosterone levels and subsequently test positive for doping</p>
	<b>Spirulina</b>	<p>Spirulina is a lignan which falls under phenols</p> <p>It is a super-antioxidant which is tasked to protect the body against free radicals and oxidative damage</p> <p>Protects against cardiovascular disease and can reduce cholesterol levels</p> <p>It can help regulate hormone levels (i.e. aid in menopausal symptoms; lessen cortisol levels [stress hormone])</p> <p>High in Omega 3 fats</p> <p>Enhances muscle strength and endurance</p> <p>It is essential for diabetics as it can manage blood glucose levels</p>
	<b>Grapeseed Extract</b>	<p>Rich in proanthocyanidins as well as beta-carotene</p> <p>Improves circulation (which aids in recovery)</p> <p>Improves collagen production (essential for strong, flexible tendons and ligaments)</p>



	<b>Rhodiola Rosea</b>	<p>Rich in <b>flavonoids</b></p> <p>Powerful antioxidant properties</p> <p>RR extract of 60mg / day for 36 days blunted post-exercise CK and CRP response after a graded exercise test to volitional fatigue</p> <p>In another study it was found that the consumption of 85mg / day for 4 weeks prior to a 75%VO<sub>2</sub>max cycle test to exhaustion had lower post-exercise CK activity</p> <p>Improved exercise performance (decreasing perceived exertion)</p> <p>Decreases stress and burnout (especially during periods of intense training)</p>
	<b>Ashwagandha</b>	<p>Rich in <b>flavonoids</b> (phenols) which protects against oxidative damage and inflammation</p> <p>Increases V'O<sub>2</sub>max with about 13% in athletes (through the action of increased red blood cell and haemoglobin)</p> <p>Increases the capacity of the blood to transport O<sub>2</sub> directly to exercising muscles &amp; hence enhancing aerobic capacity in athletes</p> <p>Has an anti-fatigue action in athletes (time to exhaustion during training sessions / exercise tests)</p> <p>Similar to caffeine in which it improves clarity and focus</p> <p>Boosts testosterone levels naturally</p> <p>It increases muscle mass and strength</p> <p>It aids in decreasing body fat percentage by increasing free fatty acid oxidation and conserving glycogen stores</p>
	<b>Kale</b>	<p>Rich source of <b>glucosinolates</b> (thiols) which protect cells against oxidative damage</p> <p>It is a powerful anti-oxidant</p> <p>Aids in weight loss</p>
	<b>Green Algae Extract / Astaxanthin</b>	<p>Astaxanthins is a <b>carotenoid</b></p> <p>It has potent antioxidant properties</p> <p>Studies in which athletes consume 4mg / day for 90 days showed lower CK levels after 2 hour intense sport-specific training sessions</p> <p>More research is needed</p>
	<b>Green Tea / Green Rooibos Tea</b>	<p>Rich in <b>polyphenols</b></p> <p>Potent antioxidant effect</p> <p>Preventative consumption of polyphenols found in green tea has been shown to alleviate signs and symptoms of EIMD</p> <p>200ml / day attenuate the CK response after exercise between 75 &amp; 90% 1RM</p>
<b>Blue and Purple Superfoods</b>	Bilberry extract	<p>Rich source of polyphenols especially anthocyanins</p> <p>Strong anti-inflammatory effect</p> <p>Assist with cardiovascular disease</p> <p>In metabolic syndrome patients, it can reduce inflammatory markers</p> <p>High in antioxidants, can be used for astringent and antiseptic properties</p> <p>Assists in urinary tract infections</p> <p>Assists in the strengthening of collagen matrices in muscles</p> <p>Known to improve night vision and daily visual function by 30% in people with glaucoma</p> <p>Reduce blood sugar levels through the enhanced secretion of insulin. This is beneficial in people with type 2 diabetes</p> <p>Assists with heart health through: improved platelet function, improved blood pressure and improved HDL cholesterol levels</p>
	Acai juice powder	<p>It is a rich source of polyphenols, specifically anthocyanins, proanthocyanidins and phenolic acids</p> <p>These phytonutrients are high in antioxidants and have a high anti-inflammatory bioactivity</p> <p>It is a scavenger of free radicals which form during exercise and would normally lead to oxidative stress</p> <p>Polyphenols are known to:</p> <ul style="list-style-type: none"> <li>Prevent exercise-induced muscle damage</li> <li>Slow the decline in force output (able to lift heavy weights for a longer period during a training session)</li> <li>Reduce pain</li> <li>Limit the decline associated with aging</li> </ul>





	<p>Elderberry Extract</p>	<p>Rich source of polyphenols (i.e. flavonoids, anthocyanins, isoquercetin)          High in Vitamin C, folic acid          Extensive research has been done and basic functions include:          Mediator for hypertension through increased diuresis          Recovery of URTI          Mediate neuropathic pain          Alleviate pain associated with headaches          Protect against oxidative stress          Mitigating the risks associated with cardiovascular disease          Exercise-specific effects:          Acting as an antioxidant is would assist with recovery purposes          In addition it has the potential to augment nitric oxide (NO) production – nitric oxide is usually found in pre-workout supplements to provide a vasodilation effect. Enhanced blood flow to muscles during exercise means more nutrients are able to reach the muscle and more waste products can be eliminated – the result enhanced muscle function</p>
	<p>Aronia berry juice powder (Chokeberries)</p>	<p>Rich in flavonoids especially anthocyanins          Contains more antioxidants than blueberries, pomegranates, cherries and goji berries          Studies with chokeberries in athletic population has shown that it decreases the inflammatory response after exercise          In addition, it plays a major role in iron levels – it increases serum levels of iron          Both of these abilities are critical for athletes to enhance the recovery phase after intense training sessions</p>
	<p>Black Currant</p>	<p>Rich in anthocyanins (phenols)          Potent antioxidant and has anti-inflammatory properties          Mitigate indirect markers of muscle damage          Supplementation with 48g in total (2hrs before and after exercise) blunts elevation in creatine kinase (CK) induced by high intensity exercise          Another study indicated that supplementing with 473ml twice daily for 8 days prior to eccentric training showed reduced circulating CK levels at 48hr and 96hrs after exercise</p>
<p><b>White and Brown Superfoods</b></p>	<p><b>Cordyceps militaris</b></p>	<p>Rich in <b>polyphenols, carotenoids and lycopene</b>          Improved glucose metabolism          Increased ventilation capacity          Vasodilation (can be used as a pre-workout supplement)          Increased ATP stores (energy levels)          Improved V'O<sub>2</sub>max and time to exhaustion          Acts as an adaptogen (regulates the body's stress response – i.e. increases energy when needed or calm the body when too excited)          Reduces recovery periods after extreme exertion as well as enhance the elimination of lactic acid          Can reduce the potential of overtraining syndrome          It increases muscle power</p>
	<p><b>Reishi Mushrooms (Ganoderma Lucidum)</b></p>	<p>Rich in <b>phenols, beta-carotene, lycopene</b>          Increase energy production          Enhances recovery after intense exercise          Increases muscle power and enhances clearance of lactic acid          Can reduce the potential of overtraining syndrome through improving testosterone levels and decreasing cortisol levels (positive T/C ratio)          It decreases depression, anxiety and fatigue</p>
	<p><b>King Trumpet Mushrooms</b></p>	<p>Rich in <b>phenols and flavonoids</b>          High in Vitamin B6, C, D, B2, B3, potassium, fiber and folate          It contains a master antioxidant named ergothioneine – this antioxidant can reduce the risk of chronic diseases          High in antioxidants and is anti-inflammatory          It improves insulin resistance          It lowers cholesterol and can aid in weight loss          Reduces the risk of breast cancer as it may inhibit the negative effects of estrogen and in effect also protect against bone loss</p>





	<b>Turkey Tail Mushrooms</b>	Rich in <b>phenols and flavonoids</b> Promotes immune function and digestive health Most heavily researched mushroom Contains more than 35 different types of phenols – potent source of antioxidants. It also contains quercetin It decreases fatigue and improve athletic performance
	<b>Shiitake Mushrooms</b>	Rich in <b>eritadenine</b> Contains immune boosting vitamins, minerals and enzymes Improves immunity (High in Vitamin D & Copper) Fights harmful cholesterol through the action of 3 compounds: sterols (block cholesterol), beta-glucans (a fiber that lowers cholesterol) and eritadenine (it hinders the formation of cholesterol) Improves repair and growth in cells
	<b>Lion's Mane Mushrooms</b>	Rich in <b>phenols</b> Boosts immune function and reduce inflammation which aids in recovery It can reduce anxiety, improve concentration, focus and overall cognitive function (memory) Improves gut health by fighting against the growth of certain bacteria and IBS Assists with diabetes management by lowering high blood sugar levels It accelerates fat metabolism which could, if unlocked, be used as an additional energy source It promotes anti-fatigue activity and hence athletic performance. It increases tissue glycogen stores, which is needed as part of the recovery process after a training session

**Figuring it all out:**

The question now becomes how will science help athletes eat enough of these important plant-based nutrients to make a meaningful performance and health impact. Up until now, research is divided either between eating completely whole fruits and vegetables on one side or using dietary supplements on the other side, with not much of anything in between. Eating whole foods is the ultimate goal, but athletes demand convenience, portability and affordability, all which count against eating whole foods at every meal and snack. A good example of this is juice that is comprised of Montmorency cherries, which aids in muscle recovery for athletes by attenuating the oxidative and inflammatory responses after exercise. To have a decent response to improve muscle recovery, the athlete needs to consume 9mg/ml of anthocyanins, which equates to 90 whole Montmorency tart cherries, twice daily. Due to these examples, phytonutrients are moving towards different delivery forms such as juices, bars, supplements etc.





If you look at the above mentioned superfoods, you will find it really difficult to find these freely in your supermarket. Some speciality stores might stock some of them, or you can buy these online, but sometimes only as single ingredients and not a combined product. However there are a few companies that have started combining these superfoods in supplements and are really assisting athletes in obtaining the best possible product. Below are some examples of companies that are making headway in this field:

<p><b>The Real Thing -Veggie Superfoods &amp; Green Powder</b></p>	
<p><b>Blast – Your Daily Reds &amp; Your Daily Greens</b></p>	
<p><b>Nature’s Nutrition – Super Greens &amp; Reds &amp; Kiddies Amazing Superfood Mix</b></p>	
<p><b>Sfera Bio-Nutrition: Single Nutrient Supplements</b></p>	
<p><b>Solgar – Single Nutrient Supplements</b></p>	

<p><b>Annique Superfoods</b></p>	
<p><b>Medi Mushrooms</b></p>	
<p><b>Mannatech</b></p>	

**Conclusion**

There are a multitude of superfoods / phytonutrients available on the market nowadays and it will get even more as time progresses. The trick is to find the ‘real thing’ amongst all of them. Usually it is those with scientific research backing their claims. Scientists are making headway in searching for the effects of superfoods on athletic performance, but this will be an ongoing process for the next 20 – 30 years. It is safe to say that superfoods or phytonutrients are here to stay....and it is about time. It provides a much safer option for athletes, although not 100% safe as with all supplements, the onus is on the athlete to take responsibility for what they eat and use as supplements. One will often find supplement companies use ‘superfood combinations’ in their normal testosterone-packed supplements – athletes should be aware of this trend.

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