



Assuming dietary supplements improve the nutritional status and physiological function of an athlete, and/or enhance exercise performance directly or indirectly; the widespread use of antioxidant supplements could be justified and may be considered necessary if a normal diet is unable to maintain an athlete's nutritional status.

ACCORDING to the AIS Sports Supplement Program, anti-oxidant vitamins C and E are listed as Category A – Approved supplements. These supplements are thought to provide a useful and timely source of energy and nutrients in an athlete's diet or have been shown in scientific trials that when used according to a specific protocol in a sports specific situation they provide a performance benefit. So, should you consider using antioxidant supplements?

Oxidative Stress

95-98% of oxygen that enters the mitochondria (the energy production control centre in cells) is converted to water in order to produce energy for the body. The remaining two to five percent of oxygen is used to generate free radicals. These free radicals are called reactive oxygen species (ROS). Oxidative stress occurs when free radicals outnumber your antioxidant defence mechanisms.

Despite some confusion about techniques that measure oxidative stress, it appears that exercise increases oxidative stress. During exercise there is an increase in free radical generation by about 10-15 fold overall and about 100 fold within the working muscles. This increase is likely to adversely affect exercise performance and has been linked to increased fatigue, muscle damage and reduced immune function.

Antioxidants

Antioxidants produced within the body include superoxide dismutase, glutathione peroxidase, catalase, and uric acid. Other antioxidants are consumed either via foods in the diet or from supplements, and include vitamin E, vitamin C, carotenoids, and flavonoids. There are two others worth mentioning, co-enzyme Q10 and glutathione, which are produced within the body and can be consumed as supplements.

Antioxidants produced in the body are mobilised from tissue stores during exercise to combat the increased production of free radicals. Further to this, antioxidant production and activity appears to be up regulated as a result of increased oxidative stress associated with exercise – which all makes perfect sense! Your body obviously recognises a crisis and acts accordingly, however, what about dietary sources of antioxidants? Do these need to increase with an increased exercise load? A couple of questions come to mind:

- Does a diet high in antioxidants protect against the increased oxidative stress associated with exercise?
- Can antioxidant supplements improve the body's response to an increase in exercise?

Antioxidant Supplements

While the majority of studies do not provide evidence of substantial benefits or performance enhancements following antioxidant supplementation (vitamins C and E), there is some support for a period of supplementation at the commencement of a period of heavy training or training performed at altitude.

It appears that vitamin C supplementation of 600-1000mg during a heavy training period may offer some protection against the onset of upper respiratory tract infections (Hemilä 1995). Furthermore, one study has shown that vitamin E supplementation maintained aerobic working capacity at very high altitude (>5000m) (Simon-

CHICKEN BURGERS

INGREDIENTS:

Chicken Patties:

- 1 kg chicken mince
- ½ cup grated carrot
- ½ cup finely chopped onion
- ½ cup diced celery

Filling:

- Hamburger buns, split
- English spinach leaves
- Tomato slices
- MAGGI Authentic Thai Sweet Chilli Sauce
- Snow pea sprouts
- Strips of char grilled capsicum

Preparation Time: 15 minutes

Cooking Time: 10 minutes

Serves: 4-6

Method: To make chicken patties, place chicken, carrot, onion and celery in a bowl and mix to combine. Divide mixture into 12 portions and shape each portion into a flat patty. Cook patties on a foil-lined grill tray under a preheated grill on medium-high, or on a barbecue hot plate, for five minutes on each side, or until golden brown on both sides and cooked through. Meanwhile, toast the bread rolls. Assemble rolls with English spinach, tomato, cooked chicken patty, snow pea sprouts and capsicum. Serve with sweet chilli sauce on the side.

Analysis:

Energy	1580kJ (377 Cal)
Carbohydrate	45g
Protein	24g
Fat	11g

From *Survival From the Fittest*, Australian Institute of Sport Department of Sports Nutrition



Schnass & Pabst, 1988).

A likely explanation is that the sudden increase in training stress leads to a temporary increase in the production of free oxygen radicals. Supplementation with antioxidant vitamins may help to reduce oxidative damage until your own antioxidant system can adapt to the new challenge.

It's not all good news though. David Nieman, a prominent researcher in the area, found that high dose vitamin E supplementation (800 IU) can increase oxidative stress during exercise of long duration (Nieman et al, 2004).

altitude or undertaking altitude house training.

The impact of an antioxidant rich diet - latest research findings

Trent Watson, at the University of Newcastle, recently investigated the differences between a diet rich in antioxidants with a reduced antioxidant diet (Watson et al, 2005). Subjects consumed either their normal diet for two weeks (which equated to a high antioxidant diet and included 8-10 serves of fruit and vegetables daily) or a restricted antioxidant

stress during exercise'. On quizzing Trent regarding the subjects' normal diets (high antioxidant diet), he reported that most subjects consumed 5-6 pieces of fruit daily, plus vegetables.

My Advice

So, what's my advice with regards to antioxidants in your diet and anti-oxidant supplements?

1. A well-chosen diet, rich in high antioxidant containing foods (fruit and vegetables) is an athlete's best defence against the increased oxidative stress associated with strenuous exercise.
2. Athletes that consume low energy diets (i.e. athletes involved in sports such as running, where low body weights and body fat levels provide an advantage) need to ensure a wide selection of foods and focus on nutrient rich foods in order to ensure an adequate antioxidant intake.
3. In essence, an athlete should increase their intake of antioxidant rich foods (fruit and vegetables) to reflect their total energy/dietary intake.
4. Moderate doses of anti-oxidant supplements (vitamin C and vitamin E) may be useful early on in athletes commencing a heavy (not moderate) training program until the antioxidant system can adapt to the new challenge and environment (altitude).

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So, supplementation with antioxidant vitamins may be useful in certain exercise situations – in excess it might be detrimental. The AIS Sports Supplement Program suggests that antioxidant supplementation maybe useful for athletes at the beginning of a period of high volume and/or high intensity training, athletes moving into hot environments or undertaking acclimatization training, or athletes moving to

diet (reduced intakes of fruit and vegetables) prior to undertaking a strenuous exercise test and blood analysis. Not surprisingly, markers of oxidative stress were significantly higher following exercise during the restricted antioxidant diet, however there were no differences at rest between the two trials.

In summarising his findings, Trent concluded "The findings suggest that a diet rich in high antioxidant foods is capable of protecting against oxidative

References:

- Hemilä H (1995) Int J Sports Med. 17:379-83.
- Nieman DC, et al (2004) Med Sci Sports Exerc 36:1328-35.
- Simon-Schnass I & Pabst H (1988) Int J Vit Nutr Res. 58:49-54.
- Watson TA, et al. (2005) Med Sci Sports Exerc. 37:63-71.