

# Super Foods for Super Health

Discover the Wonders of Australian Native Fruits



by Vic Cherikoff  
& George Kowalski



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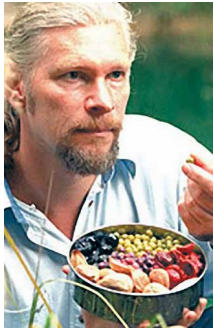
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## Significant Australian native wild foods

- by Vic Cherikoff

Looking back over human prehistory to appreciate from where we have come, gives us some insights into the real values of Australian wild foods.

Evidence suggests that modern human history began in Africa some 200,000 years ago and like all forms of life anywhere, early humans spread out from their origins to occupy every accessible niche in which they could survive and prosper. Many life forms, plants, animals and hunter-gatherer humans became part of an ecosystem and existed in an environmentally defined carrying capacity within a dynamic web of inter-dependent species. Extinctions happened but at a relatively low rate (apart from a few cataclysmic events such as Ice Ages and volcanic eruptions etc) and biodiversity was maintained over millennia, in fact, increasing over time in a natural law of rising entropy (disorder) which provided an insurance policy in which natural selection could exert its influence.

However, humans evolved to a position of choice between two paths: One choice was whether to remain as hunter-gatherers, living a tough but culturally rich lifestyle in balance with nature, respecting their food and medicine resources and their place in their ecology. They were from the land and part of it and very occasionally, in adverse seasons, the young or infirm were sacrificed for the good of the extended family.

Fortunately, this was generally an extremely rare occurrence possibly every few generations or less and generally caused by extended drought or enduring floods or other natural catastrophes and often other survival strategies avoided the extreme sacrifice. The main strategy was that the population was maintained around the carrying capacity of the land at these tough times.

The other choice in human evolution arose for a few societies with access to water, rich soils and appropriate plants and animals. Perhaps they saw a more sedentary lifestyle possible where riches could come from a dominion over nature (and possibly one family over another) through ownership of food resources or the means to produce them.

Taking a long term view, this second choice placed agrarian, agriculturalist and on to present day Industrial and then Information Age humans closer



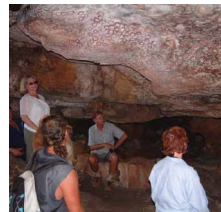
to viruses than to the living creatures with which they co-evolved. We continue to take from host species and the environment for the sole purpose of recreating ourselves, of increasing populations of more and more humans which means less of everything else. By reducing local biodiversity we take resources from other living creatures and over-populate the earth. Stealing from Peter to pay Paul has never made long-term financial or economic sense and the nutritional equivalent is equally disastrous. Many scientists now believe that we are living on borrowed time and stolen sustenance.

And what have we done to our food supply? Gone, ignored or threatened, are the generally small; nutrient dense; low sugar; often low moisture fruits which plants produced simply to spread their own seeds. Cultivated foods were selected for other than nutritional reasons. Fruits were engineered into large, sweet, watery orbs with their nutrients diluted and the plants producing them dependent on us supplying large volumes of water and planting them in deep, rich soils. Grains were developed which ripened simultaneously on their stalks – a disastrous adaptation leaving the plant exposed to seed attack by insects or birds leaving the plant with no reserves in the form of still ripening seeds. Some species completely lost any wild vigor, for example, corn has no relatives between what we know today and any wild ancestors – it is a cultivar created some 7,000 years ago solely as a food crop.

Greens were cultivated and most were also delicious to insects and herbivores which, through sheer numbers, could decimate their own food supply, species by species leaving the greens fully reliant on humans for survival. And animals on the land or harvested from the water could be hunted to extinction because there were alternative foods available and hunting methods became more efficient over time. Additionally, in the case of selected land animals, these were bred into protected, pampered herds of animals with under-used yet large muscles, with too much body fat and certainly more omega-6 fatty acids than is nutritionally good for the ultimate carnivores which ate them.

We are fortunate animals ourselves, animals with an uncanny ability to survive on an ever-narrowing food supply of diminishing quality and large brains which maximizes our resource procurement while probably accelerating our own demise.

Think of the First World cultures which are characterized by the over-

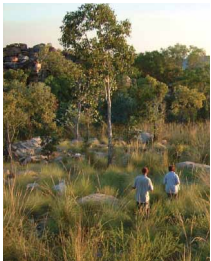


nutrition of its peoples. There is a wide choice of food quality and quantity but instinctive human taste drives to sugar and fat has undue influence in the common diet in the Lands of Plenty. Diseases of civilization are commonplace and are increasing in prevalence and include obesity, gastro-intestinal diseases, clinical depression, cardiovascular disease, diabetes mellitus (non-insulin dependent) and immune diseases. Food intolerances are on the rise demanding huge commitments from government health budgets and are a concern and aggravation for countless millions of individuals. And still we exist and expand our numbers.

At the other extreme, the developing countries' populations suffer from insufficient food and an unhealthy reliance on too few nutrients. Famine is often a consequence of the impact on the food supply by land clearing from deforestation and stock over-grazing or any natural disaster or virulent disease and is made worse by the limited quantity and quality of their foods. Overall health, immune responses and normal development of physical and mental processes are all compromised in the bad years and borderline even through the best of seasons. Yet humans remain the dominant species in numbers which threaten or preclude the existence of locally indigenous plants and animals, including food species.

In the middle, lie still other cultures where farming, fishing and animal husbandry allow human numbers to grow significantly as they develop the lifestyle of their choice in displacing other species to occupy the top ecological niches. Increasing populations demand more efficient processes to reduce biodiversity and to increase production but an ideal nutrient supply is challenged by an invariably inadequate agricultural food resource.

Now let's look more closely at the hunter-gatherer cultures which honoured the lands in which they lived and supported community and family within a natural framework that respected the land's carrying capacity over millennia. These were the hunter/gatherers who had to learn to exploit a wide range of foods and understand the seasonal calendars which could ensure at least a continuance of food or understand the patterns of the climate which then influenced their foraging strategies. Over time, they spread out into new territories but learned to match their numbers to available resources and developed ecologically sustainable lifestyles which were both nutritionally appropriate and culturally rich.



However, this was no utopia. Life was tough by today's standards of luxury. Mobility was a daily strategy, whether it was to find available food or migrate to an entirely new foraging ground in another part of one's country. Exercise was an inescapable activity for everyone and a critical injury often became a choice between survival of the individual or the family and highlighted the interdependence of clan members.

The 600 nations of Australian Aborigines are one example of this enduring way of life and they are the longest living culture on the planet today. Perhaps there is something to learn here.

Whether we would choose their lifestyle for anything other than a week-long survival test or not, there is still much to learn from more closely scrutinizing the winners of the cultural longevity race. Aborigines utilized from 150 to 650 different foods depending on whether they lived in the harsh, sparse arid zone or the lush, productive coastal tropical savannah woodlands, respectively. But compare these numbers to our food supply today: Walk through a supermarket including the fresh meat, seafood and produce sections and count the number of different foods eaten over a year. Wheat is one ingredient only even though it may be consumed in dozens of different ways. The upshot is that even for adventurous gourmards, the number of different foods totals less than 80.

So we now expect to fulfill all our nutritional needs from around half of the foods accessible to hunter-gatherers in the most inhospitable inhabited deserts in Australia or just on one eighth the food resources of traditionally living Aborigines in the tropics. Additionally, our strategy to do this is to exercise less and less as we consume more of this restricted food range while reacting to our instinctive taste drives for sugar and fat. These taste drives are interesting to consider: Free-foraging hunter-gatherers reacting to a need for sugar would work hard at digging for sweet tubers, picking fruits at their peak ripeness or finding (and more often digging or chopping for) wild honey or other sugar products from plants or insects. If successful, the harvest of these sweet foods would also yield complex carbohydrates and other forms of dietary fibre, water soluble vitamins and essential minerals.

Even these sugars were typically slow release and this provided a protective role against diabetes and cardiovascular disease.

Cravings or a drive to find fat was similarly hard work as nuts had to be





gathered over large areas of dense rainforests or animals were hunted over their natural range. Successful meals high in fat were paired with high quality protein and fat soluble vitamins (and some water soluble ones as in game meat offal with its high vitamin C content). Additionally, game meat and nut fats are more unsaturated than the fats of equivalent foods today. Domestic animals, particularly those which are grain fed but even pasture raised stock have more body fat and marbling in their muscles than any game animal.

So not only did the wild foods and their procurement strategies provide many different nutrient sources annually but work on wild foods over the last 25 years is showing that their nutritional quality is second to none.

Remember that early farmers changed the nature of the few species they selected to grow.


- Sweeter, larger fruits which are now often picked green and artificially ripened.
- Less fibrous, more starchy tubers are selected as they generally grow more quickly and are less chewy. In fact, wild tubers often contain fructans, which are complex carbohydrates including short chains of fructose rather than only glucose.
- Complex carbohydrates give a smaller rise in glucose as they are slowly digested and this negates the need for a high insulin response and avoids high circulating glucose in the bloodstream. These 'wild starches' are lost with farming and high blood glucose leads to diabetes and its complications.
- And domestic animals were bred with a different fat make up and also less vitamins in their tissues. Interestingly, wild animal organ meats have been shown to contain high levels of vitamin C which is generally considered to only come from plant sources.



Clearly, utilizing some of the foods available to traditional Aborigines would provide some nutritional advantage if simply from access to new sources of higher quality nutrients than in our modern food supply.

This makes convenient nutritious snacks and beverages the modern way to forage wild foods across Australia and some minimally developed fruits from other lands and provides fruits and herbs with which humans co-evolved over millennia.





The primary benefit derived from Australian native wild foods are the antioxidants and not only their concentration but the forms in which they are delivered. Antioxidants are chemical entities which are a natural and essential part of our diet and which detoxify free radicals formed either during the normal process of digestion and absorption of foods or from environmental sources which can be more foreign to our metabolism. Free radicals are chemicals that if left un-fettered, can cause damage to our tissues, cells and components (fats, proteins etc) that come into contact with them.

Even oxygen, although an essential chemical of life, causes oxidative damage by forming free radicals and dietary antioxidants balance this unwanted oxidation to safeguard our body processes. This damage has been linked to degenerative diseases in all our systems (cardiovascular, digestive, neuronal, ocular, etc) leading to a plethora of disorders, from cataracts to DNA damage all of which may lead to development of cancer or contribute to accelerated aging. All this makes antioxidants an essential class of nutrients and with a wide range of different types of antioxidants, increasing our dietary sources is beneficial to us from both the quality and quantity of these biological lifeguards.

## Kakadu plum

Kakadu plum or *Terminalia ferdinandiana*, which actually is not a plum but more closely related to almonds. It is in the botanic family of the Combretaceae. Other relatives include the Polynesian almond or *Terminalia catappa* and *T. muelleri* or black fruit.

Kakadu plum is now well known as the world's highest fruit source of vitamin C but it also contains significant absorptive enhancers such as iron and folates. These make the vitamin C more biologically available than if they were not present. Additionally, an important point to note is that the enhanced benefits of Kakadu plum are found when it is used as a whole fruit purée not just a juice or an extract. The purée includes all the fibre and soluble carbohydrates and also the intact cellular biochemical feedback systems which preserve the high levels of vitamin C until digestion and absorption occurs in our gut.



This is an extremely important innovation in nutritional supplementation.

By comparison, recent reports in the USA suggest that increased refined juice consumption by children is a contributing factor to the rising incidence of obesity in America. The intake of fruits has risen as recommended by the Dietary Guidelines but the fruits themselves are nutrient poor and the juices consumed do not include the dietary fibre and are often brought up to the high levels of sugar 'naturally' found in the fruits. Additionally, the sugars added are generally straight sucrose and not other simple sugars as in wild fruits.

Interestingly, more recent studies into antioxidants and wild fruits at two universities (Charles Sturt University in the Riverina and The University of NSW, Sydney) and the Australian Government's research organization, the CSIRO as a non-academic institution have revealed a high level of some other nutritionally important polyphenolic antioxidants along with the vitamin C in the Kakadu plum. Incidentally, other fruits were included in these tri-institutional studies and most of the commercial species under scrutiny are highlighted here.

Two of the phytochemicals in Kakadu plums are gallic and ellagic acids (and some closely related compounds) and both have excellent antioxidant properties.

Gallic acid has anti-bacterial, anti-viral and anti-fungal activities and also shows anti-inflammatory, anti-tumour, anti-mutagenic and anti-bronchodilatory activities and has been found to show cytotoxicity against cancer cells without harming healthy ones.

Ellagic acid also has anti-carcinogenic effects against a wide range of damaging compounds which can be present in many human tissues. The interaction between certain phytochemicals like ellagic acid and other compounds in foods is not well understood but it is unlikely that any single compound offers the best protection against degenerative diseases such as cancer. A balanced diet that includes five or more servings a day of fruits (and vegetables) along with foods from a variety of other plant sources such as herbs and spices is likely to be more effective in maintaining overall health and well-being than eating one particular food in large amounts. Consider then, the convenience of innovative snack and food beverages that integrate the approach of blending other superfoods with wild Australian natives for variety and nutritional properties.



## Wild Rosella

Another noteworthy food component is the botanically curious fruit (actually modified leaves or calyces) of the Wild rosella. Not only do these fruits contain appreciable levels of anthocyanins and antioxidant activity but the particular anthocyanins present are two of the more active chemical moieties of this family of polyphenolic antioxidants. These compounds are known as restoratives and appear to have a relaxant effect on smooth muscles, particularly the vascular system. This suggests some role in relieving or normalizing blood pressure and rosella is commonly recognized as an anti-hypertensive.



## Illawarra plum

Next we have the Illawarra plum which not only contains appreciable quantities of mucopolysaccharides or sticky sugars, which are hugely beneficial for our gastrointestinal tract health but the deep crimson colour of Illawarra plum purée is due to the content of still other anthocyanins. The antioxidant activity of Illawarra plums has been shown to be up to 7 times that of blueberries by the ORAC test for antioxidant activity.



A recent discovery by researchers at the CSIRO's Human Nutrition Division is that some as yet unknown components in Illawarra plums inhibit both, the formation of fat cells in the body and also their growth. This might just be the perfect weight loss food.

## Mountain pepper

Then onto some more esoteric compounds: In European folk medicine, Polygonum species or sneezeweeds are renowned for their anti-arthritic activity for which they have a long history of use as folk medicines. Native Australian sources of the active compound, polygodial, come from the spicy Australian mountain pepper. This plant has a long history of use as a culinary herb and reminds us that many herbs were once more important as medicines than as foods. (Besides, nothing improves the flavour of wombat more than a liberal seasoning of mountain pepper).



Some other research on polygodial has shown that it plays a protective

role for the lining of the stomach, inhibiting lesions from chemicals such as ethanol and aspirin. Additionally, polygodial is anti-asthmatic, anti-allergic, anti-inflammatory and reduces the sensitivity to pain (antinociceptive effects). It also shows some antioxidant activity.

Another phytochemical in mountain pepper is chlorogenic acid which has anti-oxidant and anti-mutagenic activity and also appears to slow the absorption of glucose on digestion. This is yet another protective mechanism against Type 2 non-insulin dependent diabetes.



## Quandong

One of the most well known wild fruits the quandong fruit which was picked as it sequentially ripened on the willow-like trees and made into jams, sauces and baked into pies. The flesh of the fruit is only a thin covering on the gnarly, spherical seed but when fresh, it contains about the same vitamin C levels as an equal weight of oranges. From nutritional research in the 1980s by Vic Cherikoff at the University of Sydney, we know that the fruit is a rich source of minerals including calcium and potassium. Carbohydrate content is around 25% of the flesh weight yet the fruit themselves are not overly sweet.

Unfortunately, little else is known of the functional phytochemicals in quandongs. The anthocyanins in the brilliant red skins of quandongs are not present in the flesh but the fact that Aborigines not only made annual pilgrimages to wild quandong stands but even took some ownership of heavily producing trees, suggests that the fruits are of high nutritional quality. This is certainly borne out with other similarly valued food species such as bunya nuts and milky plums.

## Australian native herb extracts

One ingredient in several indigenous Australian herbs is trans-anethole, common to plants of many regions around the world. This substance is currently being tested in clinical trials for its action on the learning centre of the brain and potential benefits for treating or protecting against diseases of ageing. As we grow older, the replacement of brain cells slows or may stop and antioxidants have been shown to switch on production of these essential cells resulting in a boost to our cognitive powers even into old

age. Other functional effects of anethole are similar to the phytoestrogenic activity and immune boosting power found in green tea.

Still other native Australian herbs contain essential oils which act as antimicrobials, immune stimulants and have potential as adaptogens.

This is a new field of medical research which looks at compounds which normalize bodily functions rather than treating specific symptoms of a disease state. The science of adaptogenics rose to awareness during the 2000 Olympics when Russian athletes claimed to have used herbal and mineral compounds as adaptogens to improve their performances in competition. It has been compared to blue-printing a motor or bringing it up to engineering specifications so that performance can be maximized. Perhaps the proof is in the fact that Russian athletes did rather well in their selected sports that year.

Another consideration of the contribution of superfoods in the diet is the effect of synergism. For example, anti-oxidative activity is heightened with mixtures of actives compared to ingredients in isolation. The whole cell systems confer benefits as already discussed with the Kakadu plum and combinations of essential oils appear to synergize as well so that the net result is a lot better than the sum of its parts.





## Anti-Aging With Antioxidants

- by George Kowalski

Physical trauma, emotional stress, chemical stress, and infections are all stresses that challenge man's health and cause injury or damage to the human body, in particular the vital fats in the membranes of all cells, from brain to liver. This occurs via the action of free radicals, which are molecules that cause oxidative damage to cells.

Oxidative damage or oxidation is when oxygen atoms steal electrons from other atoms, which makes the oxygen molecule stable but damages the atom from which it steals the electrons.

Ordinarily, the oxygen atom is highly unstable and subject to destruction because of its structure. Atoms are like mini solar systems with a nucleus in the centre that is orbited by electrons, like planets going around the sun. Electrons orbit in layers of eight electrons outside an inner layer of two electrons and once each outer layer of eight is filled, another layer of eight electrons orbits further out and so on.

For example, if an atom has 18 electrons, it will have one inner layer of two electrons and two full outer layers of eight orbiting electrons each and it will be stable because it has a full eight electrons in each orbiting layer. This atom, for example, is the stable gas, Argon. This gas is highly unreactive, in other words it doesn't readily react with other atoms because of its stable electron structure.

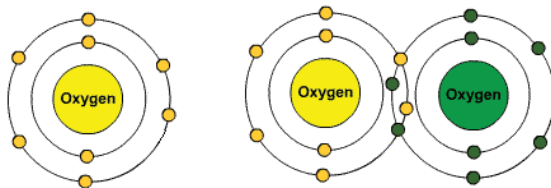
Oxygen, on the other hand, is highly reactive because it has eight electrons in total, which means one inner layer of two electrons surrounded by an incomplete outer layer of six electrons. Oxygen is highly reactive because it always attempts to steal two electrons from other atoms to complete its outer shell, which creates heat. Burning logs is an example of the chemical reaction of oxygen molecules stealing electrons from the hydrocarbons in wood, which creates the fire that releases heat energy.

Of course, we can't live without oxygen and in fact Nobel Prize Winner Otto Warburg showed that cancer lives in a low oxygen environment. Every time Warburg lowered the oxygen level in a healthy cell by 35 per cent, it became cancerous. He also found that increased amounts of

oxygen inhibits the spread of cancer cells and eventually causes the cancerous cells to die. However, the highly reactive nature of oxygen does create problems for the body. When we breathe oxygen, it can steal electrons from other atoms in the body that it comes into contact with and this releases energy. Oxygen may also just attach itself to other atoms that also need electrons to complete their outer shell, for example when oxygen attaches to hydrogen it forms water or  $H_2O$  or if it attaches to carbon it forms  $CO_2$  or carbon dioxide.

When logs burn, the black part of the smoke and the charcoal left behind is carbon ash. This is like the free radicals left behind in the body after oxygen has reacted to steal electrons. These free radicals do all sorts of damage, from wrinkling your skin to damaging internal organs, damaging DNA and contributing to the signs and symptoms of early aging.

To survive the destructive onslaught of these molecules, we need antioxidants. All life on earth has developed antioxidant systems, which neutralize the work of free radicals. Antioxidants provide protection against free radicals in order to reduce the possibility of damage to the body, which may otherwise lead to degenerative diseases.



*Diagram:* The single oxygen atom on the left shows the outer electron orbit shell having 6 electrons and needing a further two to complete it. On the right, two oxygen atoms have combined to form the more stable  $O_2$ , which is the oxygen we breathe.

## What Are Free Radicals?

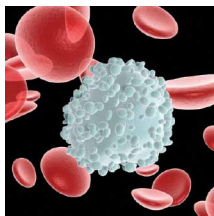
Free radicals (or free oxidising radicals) are highly reactive and unstable chemical molecules that have one or more unpaired electrons. Like a person looking for a mate, free radicals aim to quickly re-establish stability by stealing electrons from nearby, vulnerable, biological compounds in order to accompany their own unpaired electrons, and this allows them to complete themselves.





The loss of the electron from one molecule to another is called oxidation, so the vulnerable, biological compounds have been oxidized. By doing this, the free radical becomes stable, however the attacked molecule becomes a free radical itself and this sets up a chain reaction of more free radicals and ongoing damage to nearby compounds.

When one free radical takes an electron from a biological molecule, that molecule becomes unstable and it then steals an electron from another molecule, which in turn becomes unstable and steals an electron from another molecule, and so on.



## Consequences of Free Radicals

Some free radical attacks are beneficial, for example the immune system actually uses free radicals to damage disease-causing viruses and bacteria. However, most commonly free radicals do cause widespread damage in the body.

Free radicals react with biological compounds, especially the double bonds found in fats of cell membranes, and also found in the DNA molecules in the nucleus of cells. DNA is the genetic code within cells that is the blueprint or set of instructions for every cell in the body. In addition free radicals attack other lipids, protein and carbohydrates, causing tissue damage.

Free radical chain reactions lead to cellular damage and death of cells within tissues and organs. For example, a free radical may take an electron from the lipids in a cell membrane and this causes damage that leads to degenerative disease such as atherosclerosis.

Free radical damage is strongly associated with degenerative disease and age related diseases such as atherosclerosis, cardiovascular disease, insulin resistance, diabetes, cancer, cataract, premature ageing and wrinkled skin, arthritis, Alzheimer's disease, Parkinson's disease and infections.

So it is desirable to have strong protection against free radical damage, and the way the body addresses this problem is with an antioxidant defence system to cope with the many free radicals from many different sources.

## Sources of Free Radicals

In the body, free radicals arise from internal and external sources including:

- Metabolic processes, for example:
- Spontaneous oxidation of biological molecules such as haemoglobin, cholesterol and DNA
- Normal cellular energy production within cells produces oxygen radicals such as hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) and superoxide ( $\text{O}_2^-$ )
- Immune responses to infection — for instance, immune cells called leucocytes produce hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) to kill viruses and bacteria.
- Environmental hazards, for example, fried, smoked or barbequed food, cigarette smoke, air pollution, ultraviolet radiation, computer screens, television screens, heavy metals such as cadmium, lead, also mercury from pesticides, skin creams, vaccines, fluorescent light bulbs, and batteries which finds its way into waterways and accumulates up the natural food chain to large fish such as tuna and swordfish.

Excess free radical production is extremely damaging to cell integrity. So in order to combat free radicals, cells produce antioxidant enzymes as the first line of protection against these molecules; and nutrients such as vitamin C and E from dietary sources as the second line of defence against free radicals.

## What are Antioxidants?

Antioxidants are any molecules that protect the body's cells from oxidative damage caused by free radicals. Antioxidants scavenge for free radicals, rendering them inactive and incapable of causing oxidation to biological compounds.

Humans, other animals and plants maintain very complex systems of antioxidants, which either prevent free radicals being formed or remove them before they damage vital biological molecules and cause degenerative diseases.



## First Line of Defence — Enzymes

The first line of defence against free radicals is antioxidant enzymes such as:

- Superoxide dismutase (SOD), which combats the free radical called superoxide ( $O_2$ )
- Glutathione peroxidase and catalase, which combat the free radical called hydrogen peroxide ( $H_2O_2$ )

These antioxidant enzymes are of great importance for keeping us alive and healthy. However, problems arise when the production of free radicals is greater than the body's defence system of antioxidant enzymes, and the body must then employ the second line of defence against free radicals, which is nutritional chemicals that come from fruits, vegetables, legumes and grains.



## Second Line of Defence — Nutrients

The second line of defence against free radicals are nutrients and other factors found in many plant foods including:

- Vitamin C found in oranges, strawberries, bell peppers and highest of all, in Australian Kakadu plums
- Anthocyanins, found in colourful fruits potentiates or strengthens the action of vitamin C

Anthocyanins are antioxidant flavonoids and are the pigments responsible for the red, purple and blue colors of many fruits, vegetables, cereal grains, and flowers. Flavonoids are antioxidant substances in plants that give plants and flowers their bright colours.

- Polygodial, found in Mountain pepper, is a stronger free radical scavenger than blueberry antioxidants

## How Do Antioxidants Work?

Superoxide dismutase (SOD) enzyme is ubiquitous, meaning it is distributed widely in the body, indicating its significance for health. One form of SOD is

found in the cytoplasm of nearly all oxygen metabolising cells and it deactivates superoxide ( $O_2^-$ ). Its co-factors (which are substances that help it work) are zinc and copper, while another form of this enzyme relies on manganese as its cofactor — so it is important to include these minerals in the diet.

SOD does not work alone and once SOD has deactivated superoxides ( $O_2^-$ ) to hydrogen peroxide ( $H_2O_2$ ), another antioxidant enzyme, catalase, removes the hydrogen peroxide. SOD and catalase have a protective, antioxidant role which helps to reduce the risk of diseases such as Amyotrophic Lateral Sclerosis (ALS), arthritis, bursitis, gout, prostate problems, corneal ulcers, burn injuries, inflammatory diseases, inflammatory bowel disease, damage from exposure to smoke and radiation over time, plus the side-effects of cancer drugs.

Another antioxidant enzyme system — glutathione peroxidase — contains the mineral selenium as its co-factor. Glutathione peroxidase has various forms, and the cellular form protects the cell's powerhouse called the mitochondria, and also the cytosol, or internal cell fluid, from oxidation. Cellular glutathione peroxidase works cooperatively with vitamin E, which provides antioxidant protection against oxidation, within the cell membrane, especially against hydrogen peroxide ( $H_2O_2$ ).

Vitamin C is water-soluble and acts within cells and in body fluid. Antioxidants such as vitamin C neutralize highly unstable free radicals by donating one or more electrons. In doing so, vitamin C becomes a free radical itself.

However, vitamin C can recycle itself by receiving electrons back to become reactivated. The reversibility of this reaction is what makes vitamin C such an effective antioxidant. In fact vitamin C sacrifices itself to save oxidised vitamin E by regenerating it back to active vitamin E.

Vitamin C is a very important antioxidant nutrient in the mucoid surface of the lungs. Vitamin E is fat soluble and acts to protect vulnerable components of cells such as the membranes which contain polyunsaturated fatty acids (PUFAs) and other lipids including vitamin A.

The importance of this is that vitamins C and E seem to protect against certain types of cancers, so it is very beneficial to keep the body's levels of these nutrients in optimal range.





## Measuring Antioxidant Activity

Some antioxidants are more effective than others at supplying electrons. Researchers have developed tests to measure the antioxidant strength of various foods. One of these tests is called the ORAC Test (Oxygen Radical Absorbance Capacity).

This test uses a fluorescent solution to which they add free radicals and also the ingredient they want to test for antioxidant strength. The stronger the antioxidants in the food being tested, the longer it will be before the fluorescent solution loses intensity of colour.

Another way to measure an antioxidant's potential to supply electrons is to use an ORP (Oxidation/Reduction Potential) meter. Antioxidants give either a low positive or a negative reading and the lower the reading, the more available electrons it has and the greater its potential to supply electrons and therefore the stronger the antioxidant it is.



## Benefits of Plant Antioxidants

Research has shown that flavonoids can activate enzymes that reduce the risk of cancers, heart disease, and age-related degenerative diseases such as Alzheimer's disease.

Other research reported that flavonoids could prevent tooth decay and reduce the occurrence of colds and flu.

Plant foods that contain high amounts of flavonoids include acai, barley grass, blackberries, blueberries, cherries, cranberries, flaxseed, goji berries, green tea, mangosteen, pomegranate and red beans. Many other foods, including red and yellow fruits and vegetables and some nuts, contain flavonoids. Red wine is also rich in this antioxidant group.

## Acai

Acai (pronounced 'ah-SIGHee') is a type of palm tree that grows in tropical and central South America. These trees produce small, round berries twice a year. The fruits are black-purple in colour and are similar

in size to grapes. They are an important food to native South Americans, particularly in Brazil.

The high content of anthocyanins in Acai gives the berry its dark and vibrant colour. However, it is not just the anthocyanins which give acai its antioxidant capacity which has been measured at up to six times that of blueberries and approximately 30 times that of red wine.



Acai berries are also full of amino acids and essential fatty acids and contain phytosterols, which reduce blood plasma cholesterol. Acai also has high levels of calcium, vitamin E, phosphorous, iron and fibre.

Acai has:

- More protein than eggs, gram for gram
- Over 16 phytonutrients and antioxidants
- 10 times the antioxidant strength of grapes and twice that of blueberries
- 30 times more anthocyanins than red wine
- 44.2 grams of dietary fibre per 100 grams
- A low glycaemic index
- A high amount of vitamins and minerals
- Vital fatty acids similar to those in olive oil
- A very high ORAC level

In addition to its antioxidant properties, acai is antibacterial and anti-inflammatory. It is beneficial for the eyes, blood vessels, connective tissue, and the nervous system. It helps to restore other antioxidants in the body such as vitamin C, vitamin E, and glutathione. Flavenoids in the acai also help to protect the body against disease.

The acai berry also contains enzymes and co-factors such as coenzyme Q10. These help the body digest food and assist with vital chemical interactions in the body.

In scientific tests, acai has been shown to stimulate the activity of macrophages in vitro ('in vitro' means in the test tube). Macrophages are white blood cells that are an important part of the body's immune system — they actually 'swallow' and destroy foreign objects and pathogens that attack the body.

Acai extract was found to inhibit the inflammatory action caused by certain

types of bacteria in the body and the more acai that was used, the greater the effect.

Further research has shown acai extract could reduce the growth of certain leukemia cells in vitro. The researchers concluded that the acai extract activated an enzyme that plays an important role in the cell death or apoptosis of the cancerous leukemia cells.

## Barley Grass



Barley is a staple food in many cultures. Records show that barley was cultivated by humans as early as 7,000 BC. Roman gladiators reportedly ate barley for strength and stamina.

Barley grass contains many vitamins, minerals, amino acids and enzymes (superoxide dismutase and nitrogen reductase) as well as chlorophyll. It is particularly rich in potassium, calcium, magnesium, iron, copper, phosphorus, manganese, zinc, beta carotene, B1, B2, B6, B12, folic acid and pantothenic acid.

Green barley juice contains:

- 11 times more calcium than cow's milk
- 5 times more iron than spinach
- 7 times the vitamin C in oranges Around 80 mg of vitamin B12 per hundred grams

Barley grass also acts as a free radical scavenger and it has been shown to reduce inflammation and pain.

## Blueberries



Blueberries are native to North America, but they are now grown commercially in Australia and New Zealand.

One cup (145g) of blueberries provides 31 per cent of the daily dietary requirements of vitamin C, 16 per cent of the daily dietary fibre intake, 20 of the body's daily for manganese requirements and seven per cent of the daily vitamin E requirements.



Blueberries contain a high amount of anthocyanins, other antioxidant pigments and various substances that reduce the risk of some diseases, including cancers. Research has shown that blueberry anthocyanins, proanthocyanidins, flavonols and tannins inhibit the development of cancer cells in vitro. Other research findings suggest that blueberries may reduce the progression of Alzheimer's disease and other age related disorders.

Blueberries fed to animals lowered the incidence of damage from strokes. Other animal studies found that blueberries lowered cholesterol and acted on the mechanism that lowers blood pressure.

UK researchers have found that blueberries could strengthen blood vessels against oxidative stress that may lead to heart disease.

Research on rodents has also found that an increased intake of blueberries may prevent the weakening of bones that occurs after menopause. And blueberries may also help prevent urinary tract infections.

In great news for people who struggle to lose weight, rodents fed blueberry extract gained up to 10 per cent less body weight than rodents not consuming blueberry. Those same rodents on the blueberry extract also ate around eight per cent less food.

Another study on rodents showed that an extract of berry anthocyanins decreased obesity in mice whereas the whole fruit did not have the same effects. Mice consuming a high-fat diet supplemented with the purified anthocyanin extracts from blueberries and strawberries gained significantly less body weight and body fat than a control group of mice on the high fat diet with no berry supplements.

Further studies on the actions of blueberry antioxidants and the brain revealed that a diet enriched with blueberries prevented an increase in a damaging protein and oxidative damage to the brain that is associated with aging.

## Cherries

Cherries are a very popular fruit that belong to the same family as almonds, peaches, plums and apricots. However, while we know they taste great, they are also great for us, as recent research is showing.



Cherries contain vitamin C, vitamin A, bioflavonoids, ellagic acid, perillyl, anthocyanins and melatonin. The red colour of cherries comes from the anthocyanins, which are strong antioxidants that have been shown to reduce pain and inflammation.

In terms of other medical benefits, cherries:

- Help fight cancer
- Aid in the prevention of heart disease
- Relieve the pain of arthritis, gout, headaches
- Can lower blood sugar
- Ease the symptoms associated with Fibromyalgia Syndrome
- Provide a healthy and safe way to produce melatonin
- Improve physiological and mental functions

A recent study in animals by University of Michigan researchers in the USA found that diets enriched with cherries significantly lowered insulin and fasting glucose levels, which are involved with the development of type 2 diabetes. Adding cherries to the diet also lowered total cholesterol levels and triglycerides after 90 days.

Other research showed that drinking cherry juice before and after exercise may reduce muscle pain and damage.

Cherries can also help with weight loss as they are low in calories, low in fat and they contain a high percentage of water. Like most fruit, cherries are also high in potassium and low in sodium, which helps control water retention.




## Flaxseed

Flax or linseed is a plant that has been cultivated by humans for its fibre which has been used for making cloth, paper and even fishing nets. The oil of the flax seeds has been used as a food and for preserving wood.

Flaxseeds have attracted a lot of attention for their nutritional benefits.

Flaxseeds contain high levels of lignans and Omega-3 fatty acids. Lignans are phytoestrogens, or estrogen-like chemicals that also act as antioxidants. Lignans in flaxseed possess anti-cancer properties and studies performed on mice found that flaxseed extract reduced growth



of specific types of tumours. Other studies suggest that flaxseed taken in the diet may benefit individuals with certain types of breast and prostate cancers.

Omega-3 fatty acids are essential fatty acids because they are essential to human health but cannot be manufactured by the body — they must be obtained from food.

There are three types of omega-3 fatty acids: alpha-linolenic acid (ALA), eicosapentanoic acid (EPA), and docosahexanoic acid (DHA). The body can convert ALA to EPA and DHA, which are the two types of omega-3 fatty acids more readily used by the body and these two types of fatty acids are also found in high concentration in fish oils. Flaxseed contains alpha linolenic acid (ALA).

Clinical studies show that omega-3 fatty acids are helpful in treating a variety of health conditions including high cholesterol, high blood pressure, heart disease, diabetes, arthritis and osteoporosis. By controlling sugar levels and blood cholesterol, ALA is beneficial in promoting weight loss and for maintaining healthy skin.

In addition to the high concentration of omega-3 fatty acids, flaxseed contains an important lignan called secoisolariciresinol diglucoside (SDG), which is converted into enterodiols and enterolactone in the colon. There is evidence that enterolactone, may have a beneficial effect on bone health, breast health, heart health, hair loss, acne, inflammation, prostate and menopause health, and it is as an antioxidant.

Flaxseed lignans have also been linked to reducing the risk of breast cancer for pre-menopausal women by 78 per cent. In addition, daily consumption of flaxseed may stop the growth of prostate cancer tumours, according to a study in the USA.

Dietary supplement of flaxseed could also prove to reduce inflammation and oxidative stress in the lungs, as it has shown these benefits in animal tests.

Another area where flaxseed is showing promise is in limiting hair loss. A trial that supplemented the diets of male subjects with 250mg of an extract of flaxseed oil reported that 90 per cent of the volunteers showed improvement in their hair loss problem and 50 per cent reported a decrease in oil secretion in the scalp.



## Green Tea

An ancient Chinese proverb says: “It is better to be starved of food for three days, than tea for one.”

Tea comes from *Camellia sinensis* plant. The basic types of tea are: black tea, green tea and oolong tea (red) and are due to different methods of processing of the tea leaves.

Of the three types of tea, green tea undergoes the least processing and it retains more unoxidised polyphenols. These act as antioxidants and consist mostly of catechins, the most powerful of which is epigallocatechin gallate (EGCG) and which is only found in green tea.

EGCG has been shown to kill cancer cells without harming healthy tissue. It has also been effective in lowering LDL cholesterol levels and in inhibiting the abnormal formation of blood clots. Thrombosis (which is the formation of abnormal blood clots) is the leading cause of heart attacks and stroke.

In traditional Chinese and Indian medicine, green tea has been used as a stimulant, a diuretic, an astringent (to control bleeding and help heal wounds) and for heart health. Other traditional uses of green tea include regulating body temperature and blood sugar, promoting digestion and improving mental functioning — university students in Asia are known to consume volumes of green tea to keep them alert during study and exams.

Large scale studies indicate that the antioxidant properties of green tea may help prevent atherosclerosis or heart disease, particularly coronary artery disease.

In 1994 the Journal of the National Cancer Institute published the results of a study that showed drinking green tea reduced the risk of esophageal cancer in Chinese men and women by nearly sixty percent.

In one study that compared people with and without bladder cancer, researchers found that women who drank black tea and powdered green tea were less likely to develop bladder cancer. A follow-up study by the same group of researchers revealed that bladder cancer patients (particularly men) who drank green tea had a substantially better five-year survival rate than those who did not.

Other research suggests that green tea inhibits the growth of breast cancer cells. In one study of 472 women with various stages of breast cancer, researchers found that women who consumed the most green tea experienced the least spread of cancer. The researchers also found that women with early stages of breast cancer who drank at least five cups of tea every day before being diagnosed with cancer were less likely to suffer recurrences of the disease after the completion of cancer treatment.

In another study on ovarian cancer patients in China, researchers found that women who drank at least one cup of green tea per day survived longer with the disease than those who didn't drink green tea.

Further studies on laboratory animals found that green tea polyphenols inhibit the growth of cancer cells of the esophagus, which is the muscular tube that connects the throat to the stomach.

Researchers also compared green tea drinkers with non-drinkers and found that those who drank the most tea were significantly less likely to develop pancreatic cancer.

Green tea has traditionally been used to control and regulate blood sugar in the body. Animal studies suggest that green tea may help prevent the development of Type 1 diabetes and slow the progression of the disease once it has developed. People with Type 1 diabetes produce little or no insulin, which is a hormone that converts glucose, starches, and other foods into energy.

Large-scale studies have shown that men who drink more than 10 cups of green tea per day are less likely to develop disorders of the liver. Green tea also seems to protect the liver from the damaging effects of toxic substances such as alcohol. Animal studies have shown that green tea helps protect against the development of liver tumours.

There is also research indicating that drinking green tea lowers total cholesterol levels, as well as improving the ratio of good (HDL) cholesterol to bad (LDL) cholesterol. One study found that men who drink green tea are more likely to have lower total cholesterol than those who do not drink green tea. Results from an animal study indicated that polyphenols in green tea could block the absorption of cholesterol through the intestines and promote its excretion from the body. In another study of male smokers, green tea significantly reduced blood levels of harmful LDL cholesterol.



Green tea is also rich in fluoride, which is good for the teeth and prevents cavities. In addition, green tea kills bacteria that cause dental plaques and bad breath.

Green tea extract also has fat-burning properties, which promotes weight loss. One study confirmed that green tea and caffeine improved weight loss in humans. Some researchers suggested that green tea polyphenols, specifically the catechins, are responsible for the 'fat-burning' effect.



## Goji

Goji berries are the fruit of a plant in the family, Solanaceae that includes the potato, tomato, eggplant, chili pepper and tobacco plants. Also called wolfberry, goji's natural habitat is southeastern Europe to southwest Asia, although China is where the vast majority of commercial cultivation of goji berries has taken place for over 600 years.

Goji berries are full of nutrition, they contain:

- 18 amino acids, including eight essential amino acids
- Vitamins B1, B2, B6, C and E and up to 21 trace minerals including zinc, calcium, iron, selenium, phosphorous and germanium dietary fibre
- Essential fatty acids and they are 15 percent protein
- They are rich in antioxidants and have proportionately more beta carotene than carrots.



## Mangosteen

Mangosteen is a tropical evergreen tree with edible fruit that is a deep reddish purple colour when ripe. The fruit is sweet with a hint of citrus and peach flavours and it has a creamy texture.

A number of laboratory and animal studies show that mangosteen has significant anti-inflammatory effects. It is very high in the antioxidants ascorbic-acid or vitamin C and beta-carotene, which is the orange pigment in carrots.

In recent years, mangosteen has attracted special attention for its

xanthone extracts — garcinol and mangostin. These are anti-inflammatory agents with preliminary evidence for inhibiting cancer-causing cyclo-oxygenase (COX) enzymes and other carcinogens (5,6). Other research indicates that garcinol may also be an appetite suppressant and thus could be useful in weight control.

## Pomegranate

The Pomegranate fruit is a little apple-like in appearance but once opened, the inside is full of seeds which are covered in the flesh of the fruit.

There are approximately 600 seeds in each pomegranate and the seeds and flesh collectively are called arils.

This fruit, which is classed as a berry, has been used as a food for many thousands of years. Pomegranate juice is a popular drink in many parts of the world, including the Middle East and Turkey as the plant's popularity spread out from its original home in Iran (Persia).

However, there are many more benefits associated with pomegranate aside from being a popular food.

Pomegranate juice provides about 16 per cent of an adult's daily vitamin C requirement per 100ml serve and is a good source of vitamin B5, potassium and antioxidant polyphenols.

The most abundant polyphenols in pomegranate juice are the tannins, which have free-radical scavenging properties.

Pomegranate juice has been found to be effective in reducing heart disease risk factors, including oxidation of LDL cholesterol and oxidative damage to macrophages, which are linked to cardiovascular disease.

Pomegranate has also been shown to reduce blood pressure by inhibiting a certain enzyme which influences blood pressure.

In addition, pomegranate seed oil has been shown to be effective against the growth and spread of breast cancer cells in vitro. And pomegranate juice may also have antiviral and antibacterial effects and guard against dental caries.





Studies have shown that pomegranate juice, taken daily, prevented the thickening of arteries and slowed down cholesterol oxidation by almost half in some patients.

Recent scientific reports have even indicated that pomegranate fruit extracts have been shown to block enzymes that contribute to the breakdown of cartilage in people with arthritis. Combined with glucosamine, pomegranate extract could hold the key to a natural treatment for this painful condition.



Great news for pregnant mums to be is that drinking pomegranate juice during pregnancy may reduce hypoxic ischemia-related brain injuries in babies. Hypoxic ischemia is a condition brought about by decreased blood flow and oxygen to the baby's brain and it is linked to premature birth and other complications during pregnancy. This condition unfortunately causes brain injury in two out of every 1,000 full-term human births, and in a high percentage of premature babies born before 34 weeks.

Giving hope to breast cancer survivors, pomegranate seed oil has been shown to activate the process of apoptosis or the death of breast cancer cells. In addition, pomegranate juice can be toxic to some breast cancer cells, while leaving normal breast cells unaffected.



