



Antioxidants: Panacea or Placebo?

Thursday 27th May 2010, 7.30 – 8.45am

Symposium Summary

Prepared by Catherine Saxelby

New understandings on flavonoids and polyphenols

Introduction by symposium chair, Catherine Saxelby, APD, AN

Antioxidants were previously understood to act as the body's defence system, working to fight free radicals in the body and 'neutralise' them. The balance between the 'good' antioxidants and the 'bad' free radicals would determine how much 'damage' the body sustained.

Our current understanding of antioxidants questions this hypothesis. Phytochemicals have been demonstrated to act as antioxidants (free radical scavengers), but mainly *in vitro* (inside a test tube). It has proven difficult to demonstrate this free radical scavenging action *in vivo* (in the body).

A recent decision by the European Food Safety Authority (EFSA) in February 2010, to not approve antioxidant health claims in foods and beverages due to lack of evidence, means health care professionals need to reconsider how these compounds work and how to explain this to consumers.

EFSA concluded, that '*...no evidence has been provided to establish that having antioxidant activity/content and/or antioxidant properties is a beneficial physiological effect*'. EFSA stated that a range of antioxidant foods and constituents do not deliver '*antioxidant properties*' or protect body cells, DNA, proteins and lipids from oxidative damage (www.efsa.europa.eu).

The current antioxidant definition groups together thousands of diverse compounds which implies one mechanism of action and is incorrect. Nutrition research to expand the known actions of these compounds, we now call antioxidants, is required.

Conclusion

Catherine concluded by suggesting that the value of a nutrient-rich daily diet which includes vegetables, fruits, whole grains, nuts, tea and possibly a limited quantity of red wine and dark chocolate is still warranted. These foods remain the cornerstones of a healthy diet rich in phytochemicals for good health. The challenge is to understand their chemistry and mode of action in more depth rather than marketing them all under the 'same umbrella' as in the past. Therefore, moving forward we need to look at phytochemicals, rather than antioxidants. For tea, this means tea flavonoids rather than tea antioxidants.

Flavonoids and Health - Is tea rich in antioxidants?

Jonathon Hodgson, Research Professor School of Medicine and Pharmacology, University of Western Australia

The definition of an antioxidant is *'a substance that inhibits oxidation or inhibits reactions promoted by oxygen or peroxides'* or *'a substance that prevents damage caused by free radicals'*.

The antioxidant hypothesis is that antioxidants may help to prevent oxidative damage in the body and therefore slow aging and reduce risk of chronic disease.

Antioxidant vitamins include: Vitamin E (lipid soluble), Vitamin C (water soluble) and Vitamin A or beta-carotene (lipid soluble). Meta-analyses of randomized controlled trials (RCTs) conclude that antioxidant supplements alone or in combination do not reduce mortality. Results of meta-analyses have, therefore, led to caution in the area of antioxidant research and has questioned the antioxidant hypothesis.

Flavonoids are acknowledged as a major class of polyphenols. Many *in vitro* studies have confirmed that many flavonoids are potent antioxidants *in vitro* (inside a test tube), however, most RCTs have failed to demonstrate reduced oxidative damage *in vivo* (in the body). Early population studies suggested a protective effect of flavonoids on CVD and further meta-analyses of these studies indicate that a higher flavonoid intake is associated with a 10-20% lower risk of CVD.

Tea, which comes from the *Camelia Sinensis* plant, is an important source of flavonoids in the diet. The average total flavonoid intake is 500-1000 mg/day and tea is believed to often contribute greater than half total flavonoid intake. In Australia, tea contributes 70-80% to total flavonoid intake.

Populations studies have demonstrated that tea drinking (black or green, 2-4 cups per day) is associated with a 10 -20% lower risk of stroke and heart disease. Studies looking into the possible mechanism for this health benefit have suggested the following potential mechanisms:

- Reduction of oxidative stress
- Improved endothelial function via increased nitric oxide
- Lowered blood pressure
- Lowered blood cholesterol
- Reduced inflammation
- Improved platelet function
- Reduced visceral fatness
- Reduction in the development of atherosclerosis

Conclusion

Professor Hodgson concluded by outlining that the term 'rich in antioxidants' has become misleading to the public and that tea and other antioxidant rich foods and beverages should be described more precisely. In the case of tea the solution is to describe tea as 'rich in flavonoids' and to describe the bioactivity of flavonoids, for example, *'tea is rich in flavonoids; flavonoids are vasoactive compounds which can help to relax blood vessels; this may result in reduced risk of heart disease'*.

National Heart Foundation Position Statement: Antioxidants in food, drinks and supplements for cardiovascular health

Tuesday Udell, National Heart Foundation

This position paper covers: Vitamin C, Vitamin E, Beta-carotene or Vitamin A and polyphenols, in particular phenolic acids and flavonoids. These were identified as the most commonly found antioxidants found in food and drinks that Australian's consumer.

The following NHMRC levels of evidence were used to categorise the position statements level of evidence.

NHMRC Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials (RCT).
II	Evidence obtained from at least one properly designed RCT.
III-1	Evidence obtained from well-designed, pseudo RCTs (alternate allocation or some other method).
III-2	Evidence obtained from comparative studies with concurrent controls and allocation, not randomised cohort studies, case-control studies or interrupted time series with a control group.
III-3	Evidence obtained from comparative studies with historical control, two or more single-arm studies or interrupted time series without a parallel control group.
IV	Evidence obtained from case series, either post-test or pre-test and post-test.

Key findings:

Fruit and vegetables

A diet rich in fruit and vegetables:

- can result in a modest fall in systolic blood pressure in people with and without hypertension (II)
- is associated with lower cardiovascular mortality, a reduced risk of stroke and a lower risk of cardiovascular disease (III-2).

Black and green tea

- Drinking tea or consuming tea-flavonoids improves endothelial function (II)
- There is limited evidence that drinking green tea or consuming tea-flavonoids reduces visceral fat (II)
- Regular tea drinking is associated with a reduced risk of cardiovascular disease (III-2).
- The beneficial effects of tea are attributed to the high flavonoid content and appear to have the most benefit on endothelial function.

Cocoa

- Intake of high polyphenol cocoa or high polyphenol chocolate improves endothelial function over the short-term (I)
- Consuming high polyphenol (≥ 500 mg) cocoa and/or up to 100 g/day of high polyphenol (≥ 500 mg) chocolate can modestly reduce systolic blood pressure (II)
- Cocoa and/or chocolate intake reduces platelet reactivity (II).
- While the results for cocoa were positive for endothelial function, systolic blood pressure and platelet reactivity, the levels used in the experiments were far higher than levels found in commercial drinking chocolates and chocolate bars.

Coffee

- Five or more cups/day causes an increase in blood pressure (I)
- Boiled coffee increases LDL cholesterol and total cholesterol levels (I)
- Coffee consumption has little impact on risk of heart disease (III-2)

- Not associated with increased rates of heart failure hospitalisation or cardiovascular mortality (III-2)
- Prospective studies are inconsistent regarding coffee intake and development of hypertension (III-2).

Red wine

- Conflicting and insufficient evidence exists regarding the heart health benefits of polyphenols in red wine (no level of evidence allocated)
- Majority of evidence points to the detrimental effects of alcohol
- Findings around resveratrol (found in skin of grapes) are still emerging.

While it was expected to find mostly positive findings regarding the polyphenols in red wine, much more evidence regarding the detrimental effects of alcohol was found. The findings around resveratrol (found in the skin of grapes) is still emerging and the NHF will be watching out for the results of these studies.

Supplements

- Supplemental vitamin E does not decrease all-cause mortality or cardiovascular mortality or prevent cardiovascular events (I)
- Consuming beta-carotene supplements increases cardiovascular mortality and all-cause mortality in smokers (II)
- No evidence for effectiveness of combination supplements preventing cardiovascular disease (II)
- Conflicting evidence regarding effect of supplemental vitamin C and heart disease risk (III-3).

Conclusion

Overall, antioxidants (vitamins and polyphenols) are beneficial for health, in particular cardiovascular health, in adults and will be consumed as part of a balanced diet that contains a wide variety of plant-based foods

The NHF's Antioxidant recommendations can be summarised as follows:

Source of antioxidants	Good choice for CVH	Heart Foundation Recommendation
Fruit and vegetables	yes	At least 2 serves of fruit per day. At least 5 serves of vegetables per day
Tea	yes	Either black or green tea made with leaves or tea bags. May add reduced, low or no fat milk.
High Polyphenol Cocoa	yes	Use raw cocoa powder in drinks and cooking.
Chocolate	no	Most commercial cocoa and chocolate will be poor sources of antioxidants.
Coffee	limit	Drink fewer than 5 cups per day of paper-filtered, percolated, café-style or instant coffee in preference to boiled or plunger coffee, if you already drink coffee.
Red wine	no	The <i>amount</i> of alcohol consumed has more impact on CVH than the <i>type</i> of alcohol consumed. Healthy Australians should consume no more than two standard drinks per day, if you already drink alcohol.
Antioxidant supplements	no	Combination or individual antioxidant supplements are not recommended for the prevention of CVD.

Electronic copies of the summary of evidence and position statement are available at www.heartfoundation.org.au/antioxidants. For more information delegates can call the NHF Health Information Service **1300 36 27 87**.

The Mystery of Tea

Vatan Ercal, Unilever Tea Technologist

Tea is an evergreen plant and a member of the Camellia family. Tea grows in mildly acidic (4-5.5 pH) soil at relatively high altitudes. The optimum growth temperature is 18-30°C and tea thrives in a well-distributed rainfall of min 1,500mm per year.

Left to grow wild the tea plant develops into a tree 10-20m high, but for cultivation is kept to a height of approximately 1m. A tea bush may produce good tea for 60-80 years, although the yield will drop after 50 years. At this time the plant will be replaced by a new plant from a nursery. The life span of the tea bush is about 100 years, although the oldest living bush is around 800 years old.

Tea originates from the fan-shaped area between the Naga, Manipuri and Lushai hills along the Assam-Burma (Myanmar) frontier in the west, through to China in the east and from this line southward through the hills of Burma and Thailand into Vietnam. This is an area of monsoon climates with a warm wet summer and a cool dry winter. The biggest tea exporting countries are Kenya and Sri Lanka. Although China and India produce more, this is mostly for domestic consumption.

The tea bush was previously cultivated from seeds. Nowadays it is usually from cuttings. Cuttings are rooted in sleeves in nurseries and must be kept cool and moist. The optimum temperature of the nursery should be 25-30°C and cuttings need to be watered frequently (often by misting). Cuttings are re-potted and planted after approximately one year.

Plucking is traditionally done by hand, however, some estates use mechanised plucking. The young leaves (flush), usually the top two leaves and the bud on each stem are plucked. The younger and softer the shoots, the better the tea. In some countries tea crop is seasonal, in others, it can continue throughout the year.

After plucking leaves are dried in a pan (Chinese) or steamed (Japanese), then cut and dried. This produces green tea. To produce black tea, the leaves then go through fermentation which changes the colour from bright green to copper. Oolong tea is produced via semi-fermentation.

Withering is the partial removal of moisture. Hot air of 25-30°C is passed through the tea leaves resulting in a 40% weight loss. A withered leaf has the smell of apples.

Cutting and rolling then cuts the leaf into small pieces. Leaves are rolled through rolling machines which break up the cells, releasing the natural juices and enzymes.

Fermentation is the critical stage where the colour, flavour and mouth feel of tea is determined. The leaves are spread on clean trays in a cool humid atmosphere. After a few hours the rolled leaf takes a bright 'coppery' colour.

Drying is used to complete moisture removal. To arrest fermentation the leaves are taken through hot air chambers where they take their final appearance. This results in the leaf taking on a caramel smell of burnt sugar. The dried leaf is then sorted into grades through sifting machines that vibrate the leaf through different sized meshes into holding bins.

Tea is then assessed by tasting and appearance via a process which is quite similar to wine tasting. Tea tasters are trained over many years to deal with hundreds of samples which arrive from different corners of the world. On a busy day a tea taster may taste 400-600 different teas.