

Phytonutrients

Introduction

There are few words in nutrition as all encompassing as the term phytonutrients, which literally means “plant based” nutrient. When you consider this is a relatively new term (used generally to describe all those nutrients science hasn’t yet identified and synthesised in the laboratory) it is strange that we don’t use it more. At its broadest it actually defines all the nutrients we need in our diets. Some (such as Vitamin A or EPA for example) are not available from plant sources, but if they are healthy our bodies can metabolise these nutrients from the parent molecules found in plants.

If we were to speak literally all nutrients from plant sources would be classed as phytonutrients, we must clarify here that the health benefits bestowed by whole plant foods are rarely preserved when nutrients are isolated and packaged into supplements. Plant components therefore cannot really be classed as phytonutrients (in the beneficial, fully nutritious sense of the word) unless they are present within the plant matrix.

If you consume a broad range of plant foods you will take in a good spectrum of phytonutrients. Whether it is enough depends upon the needs of your body and the status of the food. We shall therefore in this lecture explore the range and nature of plant constituents, their physiological actions and their nutritional/therapeutic value.

Just to set the scene and show the range of nutritional support whole foods can provide, we know of at least 4000 compounds that fall within the categories of flavonoids and carotenoids alone. Therefore single ingredient supplements can never achieve the level or complexity of nutrition that whole foods do.

Isoflavones

Classed as both bioflavonoids and also a type of phyto-oestrogen (the other type being lignans) isoflavones are phenolic compounds. Isoflavones block the binding of oestrogen or testosterone to their receptor sites on cell membranes within the body. In people susceptible to hormonal cancers this can help reduce the aggressive actions of these steroidal hormones and, thereby, help reduce the risk of the cancer. One of the most heavily researched isoflavones, genistein, has been found to be a powerful inhibitor of cancer cells because it stops the production of oncogenes, which are the genes that cause cancer (‘onco’ meaning relating to cancer – e.g. cancer specialists are often called ‘oncologists’). As if this were not enough genistein has also been shown to inhibit the growth of new blood vessels thereby starving the cancer of its food supply.

However we must exercise caution in spite of media interest in soy as being the reason for the low incidence of cancer amongst high soy consuming nations. Although there is no doubt that if we all consumed more isoflavones in our diet we would be healthier as a result, consuming huge quantities will not necessarily make us healthier still. It is not necessarily the case that one culture’s native diet will be as beneficial to another group with a different heritage

Sources

Soy is a key source of isoflavones

Flavonoids (also known as bioflavonoids)

Flavonoids are typically water-soluble compounds, which were first grouped together by Szent Gyorgyi in the early 1930s under the name of Vitamin P. Over 20,000 flavonoid compounds have now been identified. To simplify things they have been categorised into 12 sub-groups, many of which are powerful antioxidants. Some help to maintain the normal function of the blood vessels, while others protect against inflammation, act as anti-histamines, improve blood/oxygen supply, strengthen capillaries and protect against artery disease. Others help to protect their plant hosts against viruses, bacteria and fungi. In addition to this, research has shown that flavonoids can help stop the spread of cancers by shielding collagen and elastin matrix fibres that hold us together from enzymes called matrix metalloproteases. These are produced by cancer cells to tear the fibres apart therefore protection from them is vital in preserving the integrity of connective tissues.

Interestingly enough, research into flavonoids has shown direct support for the herb milk thistle, which has traditionally been used to help cleanse the liver. This support is based upon the fact that milk thistle contains large quantities of a group of flavonoids that have been

shown to concentrate their efforts mopping up free radicals in the liver. This is an excellent example of modern science catching up with traditional herb lore.

Sources

The average diet contains between 25mg and 1g of flavonoids per day. With the highest concentrations being found in the skins and seeds of fruit and vegetables. Particularly high concentrations are found in: apples, prunes, citrus fruits, cabbage and lettuce and in particular the most heavily researched flavonoids have been found in the following:

Onions and Apples - *Quercetin*

Quercetin is a powerful anti-oxidant and anti-inflammatory compound as well as being particularly cardio-protective.

Grape seed, red wine, pine bark – *Procyanidins*

In the form of pine bark extract (pycnogenol) and grape seed extract this group of flavonoids is already gaining much credit as a powerful antioxidant. It is particularly associated with treatment of arthritic conditions because of its ability to stop the breakdown of the lubricating synovial fluid within arthritic joints. In addition this group also has anti-permeability effects on blood vessels and a protective effect on connective tissues.

Tea – *Catechins*

Extracts of green tea have been used to help support the functioning of insulin within the body and it has been suggested that they may even help the body regenerate its beta cells used in

insulin production. The capillary strengthening properties of other flavonoids would also support this effect.

A survey published in 1998 showed that consumers of high quality chocolate, like wine drinkers, lived longer. This is presumably because good quality dark chocolate has a high flavonoid content.- excellent news!

Summary

Flavonoids in the skin of fruits and vegetables typically provide the blue and red colours while their physiological actions are overall anti-inflammatory and antioxidant so help alleviate allergy symptoms and inappropriate inflammation.

Phytosterols

These compounds have crept into the public's awareness through the promotion of novel foods such as margarines and yoghurt that are promoted to help lower cholesterol levels in the body by providing phytosterols, which fill up cell receptor sites normally taken by cholesterol. This stops cholesterol binding to the cell thereby encouraging the body to transport it back to the liver and hopefully excrete it. As a result of this the amount of cholesterol in the blood stream is lowered and the fear over excess cholesterol is reduced. What is not achieved however, through this medical use of food, is an understanding as to why the cholesterol was high in the first place, therefore the cause is not cured.

Phytosterols are generally poorly absorbed and remain in the gut, therefore they are thought to protect against the harmful effect of certain bile acids. These bile acids are formed from cholesterol and can have mutagenic and carcinogenic properties. This may also explain why some phytosterols can have a beneficial effect with regards to protecting against colon cancer.

Carotenoids

Carotenoids are a family of more than 700 naturally occurring yellow, red and orange pigments found in vegetables and fruits (also specific carotenoids have been identified in bird feathers and crustaceans). Carotenoids are always present in photosynthetic plant tissues (being accessory pigments for chlorophyll) and high quantities are also found in other plant tissues.

We have all heard of beta-carotene and some of you may also have heard of alpha carotene as well. What may be new to you however are the main antioxidants in the retina, which are the carotenoids lutein and zeaxanthin.

The optimal strategy to support eye health is a combination of lutein, zeaxanthin, vitamin C, vitamin E, lycopene (found in tomatoes), selenium, EPA and DHA. Programmes such as this have shown tremendous results with age related macular degeneration, which can make a huge difference to someone's life.

Dietary fats (consumed in small, but not excessive quantities) facilitate the absorption of dietary carotenoids because carotenoids are fat-soluble structures. Once inside the body lipoproteins transport carotenoids from the liver to the various organs of the body where the carotenoids exert their therapeutic effects.

In general, however, dietary carotenoids are poorly absorbed when consumed orally – 2-50%, depending on various factors. Carotenoids from raw foods are least absorbed. Fortunately cooking doesn't appear to harm carotenoids so mild heat during cooking is the best option as it improves the bioavailability of most carotenoids without harming them.

Sources

Fruits and vegetables, particularly the yellow/red coloured ones: e.g. carrot, red pepper and squash/pumpkin.

Indoles

Indoles were formerly known as vitamin U. There are several recently identified compounds that used to be classed as this vitamin whose main benefit was in helping to prevent the formation of stomach ulcers (hence the letter U).

Out of all the indoles, probably the most commonly supplemented is indole-3-carbinol, which has shown activity against cancer in several studies. It is also connected to endogenous production of glutathione in the liver. Glutathione is a key tri-peptide in the body that has many positive functions supporting the immune system and so any substance that helps create glutathione is going to be supportive to overall health.

Sources

Good sources of indoles and indole-3-carbinol in particular are: cabbage, brussels sprouts, kale and broccoli.

Organic Sulphur compounds

Probably the most famous organic sulphur compound is MSM (when talking about supplemental forms). However, the most common organic sulphur compounds are the amino acids: cysteine, cystine, methionine and taurine. It is the sulphur in these that allows protein chains to fold up on themselves. This in turn creates the biologically active shapes that many proteins and polypeptides need in order to perform their functions within the body.

Note that in chemistry 'organic' refers to carbon containing substances, but in this instance it can also mean 'naturally occurring' or 'living' sources.

Methylsulfonylmethane (MSM) is a type of sulphuric compound that is naturally present in the body, although it is made in the body, its production tends to decrease with age. MSM has been credited with curing and treating all sorts of ailments from joint pain through to reducing snoring. Some of these claims are easier to understand than others, but as with any case of one pure molecule carrying such a range of health claims, the quality of the source material is most important if one is going to get any benefit from supplementing with this

product. Alternatively one could just increase the content within the diet particularly if it is the sulphur itself you feel you need. Suppliers of MSM do suggest that it is more than just a supplier of sulphur and that it has its own functions above and beyond just delivering this mineral. There is research that does support this claim (anti-inflammatory functions for an example) and claims that in cases of joint pain, relief can be felt faster with MSM than with Glucosamine sulphate which is another well known joint supporting nutrient. It is important, however to remember that not all products with the same name actually are the same.

Sources

Sulphur rich foods include eggs, onions, garlic and other similarly smelly foods.

MSM is a constituent of raw fruits, vegetables (especially cruciferous vegetables), seafoods, meat and milk. It is extremely volatile and is highly susceptible to loss and degradation during food processing. Most people do not ingest significant amounts of MSM from food (unless the diet is composed primarily of raw foods).

Curcuminoids

As with the isoflavones above, curcuminoids are also phenolic compounds and so can work along similar lines. There are three main classes of curcuminoids: curcumin, curcumin II and curcumin III, all of which are found in turmeric, but cumin seeds also contain curcumin itself. Curcumin is the most researched of the 3 classes and has shown positive results in supporting the immune system. It does this again by helping the manufacture of glutathione, as well as interleukin 4. In addition it is a strong antioxidant and has been shown to be helpful in lowering excess cholesterol levels and helping alleviate irritable bowel syndrome through its anti-inflammatory properties.

The powerful functions of curcumin within turmeric and cumin seeds shows the strength of effect our food itself can have when used in the right way at the right time.

Herbs And Botanicals

Although learning about medicinal herbs is far beyond the scope of these notes it is worth an overview and an awareness that herbs tend to be concentrated powerhouses of phytonutrients. They do however have a variety of potential contraindications, in addition to their benefits and so they are best treated with care. Proper training should be gained before using medicinal herbs therapeutically.

Saying this though, there are many culinary herbs, which can make a positive addition to our diets even though we tend to only think of them as flavourings. Herbs such as mint, parsley, rosemary, oregano, chamomile, turmeric (as mentioned above) and garlic can all make a positive difference to taste as well as well as potentially to health.