

Money Down the Toilet

A critical look at the need (or not) for nutritional supplements

The terms 'down the toilet' or 'down the drain/gurgler' are frequently used as hyperbolic metaphors to describe waste; especially when that being wasted is money. Literally speaking however, most things that are wasted, including money, do not actually end up in a toilet — this is just a saying. The enormous amount of money that Australians spend each year on vitamin and mineral supplements, however, is an exception. The excessive amounts that are ingested in the pills, powders or potions, that people pay big bucks for, are generally passed through the body and are excreted as waste; quite literally into the toilet. This article takes a critical look at the need for vitamins, and explains why popping vitamin pills is not simply a poor substitute for a healthy diet, it is a waste of money and may be potentially dangerous.

Supplement use

In 1986, the Parliament of Victoria Social Development Committee published a study which revealed that the health-food industry had grown rapidly between 1970 and 1986, resulting in a five fold increase in health-food outlets.¹ To date, the largest study to examine the prevalence and cost of alternative medicine in Australia was performed by MacLennan & co-workers in 1996.² They found that the overall use of at least one non-medically prescribed alternative medicine was 48.5 %,

and that the majority of these were non-prescribed vitamin and mineral supplements. They calculated that Australians spent approximately \$621 million dollars annually on supplements and other alternative medicines; almost twice as much money as that spent on pharmaceutical drugs. Furthermore, in 2000 the same researchers discovered that there had been a 120% increase in the amount spent annually on supplements and other alternative medicines since 1996.³

Reasons for taking supplements

When asked why they take vitamin and mineral supplements, many people explain that it is because they fear that they may not be getting enough from their food alone, and that our food supply is somehow lacking in the nutrients we need to stay healthy. In reality, nothing could be further from the truth — this single misconception is largely responsible for the widespread unnecessary use of these supplements.

Nutrient Depletion

The source of this misconception probably comes from advertising material pushed by supplement companies; often making vague, generalized statements about it being difficult to obtain adequate vitamins and minerals from our food supply, due to farming techniques, nutrient depletion and processing methods.



Stuart Adams is a qualified nutritionist (with a real degree from from a real university) who writes articles and regularly lectures for Nutrition Australia.

US Senate Document 264

A frequently cited source of this information is known as *US Senate Document 264*. Below is an extract from this document;

Do you know that most of us today are suffering from certain dangerous diet deficiencies which cannot be remedied until depleted soils from which our food comes are brought into proper mineral balance?

The alarming fact is that foods (fruits, vegetables and grains) now being raised on millions of acres of land that no longer contain enough of certain minerals are starving us — no matter how much of them we eat. No man of today can eat enough fruits and vegetables to supply his system with the minerals he requires for perfect health because his stomach isn't big enough to hold them.

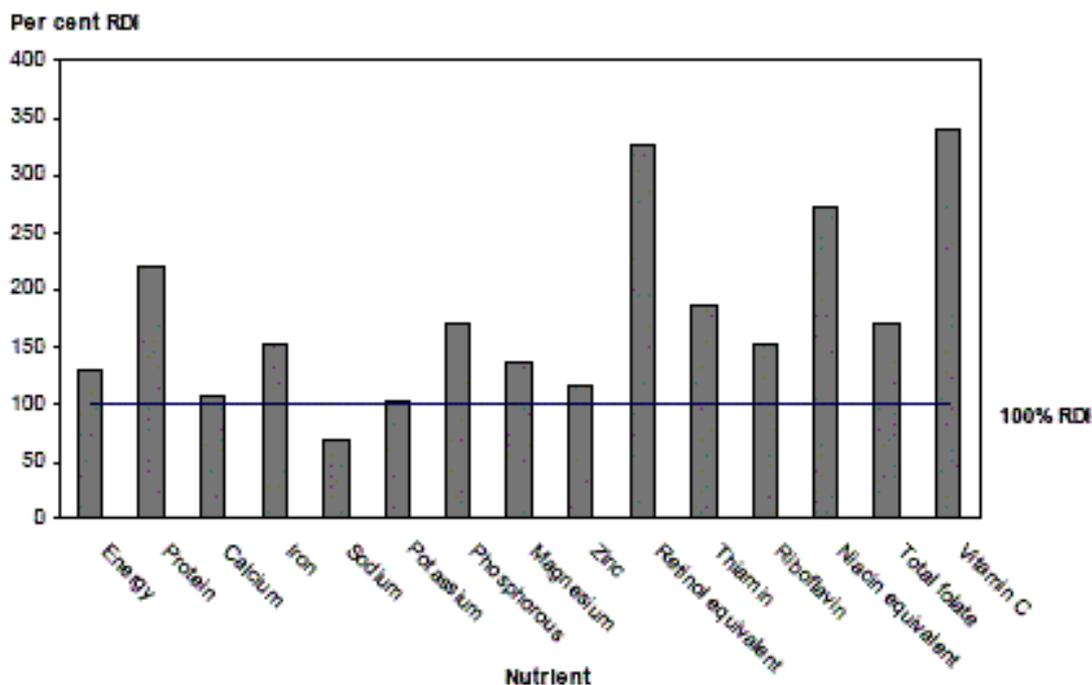
Donald Davis PhD, of the University of Texas at Austin, located this particular document and discovered that it is merely a reprint of a base-

less opinion piece that originally appeared in the June 1936 issue of *Cosmopolitan* magazine and was placed into the Congressional record by a Florida senator. It did not arise from any government research study, or any scientific study at all; it was simply a speculative opinion that happened to catch the attention of a US politician. Davis presented his findings in the November, 1997, *Townsend Letter* and reported it to the National Council Against Health Fraud (NCAHF), who have since published warnings to consumers to be wary of those citing this erroneous document as evidence of nutrient depletion.⁴

Nutrient Availability

A few years ago, the Australian Institute of Health and Welfare published a report which examined the supply and availability of nutrients in Australian foods, as well as their apparent consumption.⁵ The food consumption data was derived from *The Apparent Consumption of Food-*

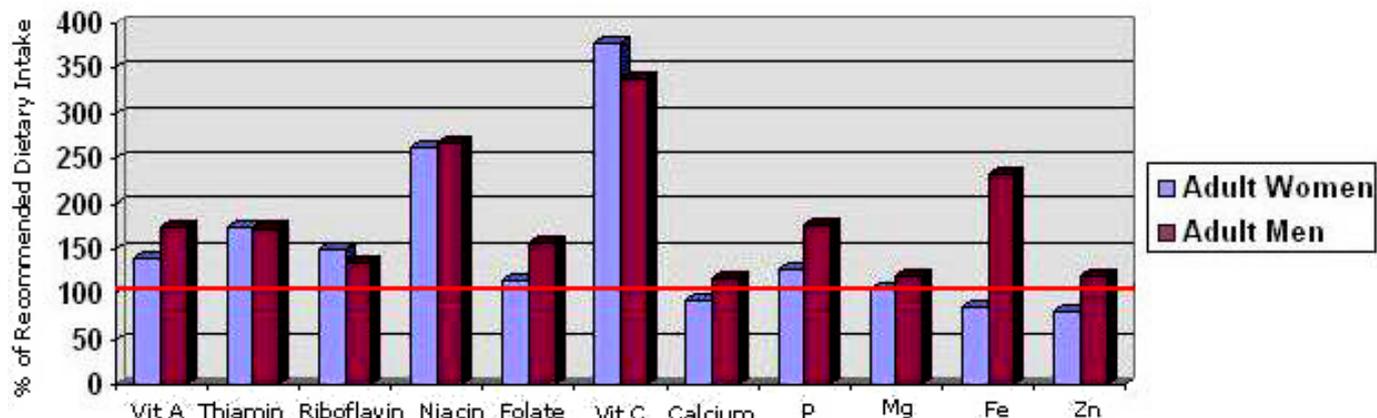
stuffs compiled by the Australian Bureau of Statistics (ABS). The report estimated the nutrient content in the food supply of all foodstuffs available for consumption by the Australian population, from which assessments could be made as to whether the nutrients available for consumption are adequate to meet the needs of the population. The results of this data take into account the expected nutrient losses that may occur from various processing and cooking techniques, and also other potentially confounding variables, so that the data accurately reflects actual nutrient consumption by consumers. The results indicate that the supply of nutrients available remains relatively constant over many years and that the Australian food supply is characterized by an abundance of macronutrients, as well as vitamins and trace minerals. The following graph represents the nutrient consumption per capita, in relation to the Recommended Dietary Intake (RDI) levels.⁵



Note: Sodium data do not include salt added to processed foods or discretionary salt use.

Figure 2: Apparent per capita consumption of selected nutrients as a percentage of RDI, 1997-98

Vitamin and Mineral intakes of Australian adults. (% RDI)



Source: Australian Bureau of Statistics. National Nutrition Survey: Nutrient Intakes and Physical Measurements Australia

Evidently, the availability of nutrients in the food supply substantially exceeds the RDI levels. Other studies which have examined the composition of foods in various areas of the world have also indicated that there is generally an abundant supply of nutrient availability in foods consumed in Australia⁶⁻⁸ as well as Great Britain⁹ and the United States.¹⁰

Nutrient Intake

This evidence clearly shows that the vitamins and minerals are there in our food supply, however many people may believe that they are not getting enough of them due to poor dietary habits. Once again, this is a common misconception.

Throughout 1995, the Australian Bureau of Statistics surveyed approximately 16,400 homes evenly distributed throughout Australia, collecting data for the National Nutrition Survey.¹¹ The purpose of this study was to provide insight into the dietary habits of Australians and assess what areas of nutrient intake were of the greatest concern. The information collected by ABS researchers revealed that the average vitamin and mineral consumption among adults was generally greater than RDI levels, as represented by the graph below (in relation to RDI levels).

Recommended Dietary Intakes – a bare minimum?

Another common misconception is that the Recommended Dietary Intake (RDI) levels (also called Recommended Dietary Allowance (RDA) in the US), are the bare minimum levels of specific nutrients needed to avoid a deficiency, and that it is somehow advantageous to obtain much higher levels.

The RDI for vitamins and minerals are devised by the National Health and Medical Research Council, and are designed to be greater than the actual physiological requirements; thus providing a kind of metabolic 'safety net'.¹² They state:

Recommended Dietary Intakes (RDIs) are the levels of essential nutrients considered adequate to meet the nutritional needs of most healthy individuals. They are based on estimates of requirements for age and sex groups and, therefore, apply to group needs. As they incorporate generous factors to allow for variations in metabolism, absorption and individual needs, RDIs exceed the actual nutrient requirements for practically all healthy people. Therefore, they are not synonymous with requirements.

Issues to be taken into account when comparing population intakes with RDIs include:

- The RDIs exceed the actual nutri-

ent requirements for practically all healthy people, as described above;

- *The proportion by which the RDI exceeds the mean physiological requirement differs between nutrients. Some RDIs incorporate more generous factors to allow for variation in absorption and metabolism. It is therefore not possible to compare directly the proportion who exceed the RDI for different nutrients.*

To give an example, the minimum amount of Vitamin C needed to prevent and cure a deficiency (scurvy) in adults is approx 5-10mg/day^{13,14} yet the RDI is set at 60mg/day in Australia¹² and even larger in the US.¹³ Our plasma concentrations become 'full' at around 200mg/day, at which point we start to excrete excess levels. Although excess amounts are excreted, they alter the equilibria of various biochemical pathways in the body (in the case of vitamin C, the synthesis of certain sex hormones can be disrupted, resulting in alterations in the ratio between progesterone and oestrogen which may induce miscarriage in early pregnancy.¹⁴) Most studies indicate that in healthy people, amounts greater than the RDI do not appear to be helpful. With a few exceptions, little or no evidence exists to support the notion that larger than RDI levels of micronutrients are needed for 'optimum health'; in fact, 'mega' doses of certain nutrients such as vitamin A,

Niacin, vitamin B6, vitamin D, folic acid, iron and selenium can very easily become toxic.¹⁴

When are supplements appropriate?

Not all vitamin and mineral supplements are entirely worthless. There are certain conditions that may necessitate the use of dietary supplements.¹⁴ Some examples include:

- Folic acid among women of child-bearing age
- Therapeutic administration of folic acid, vitamin B6 and vitamin B12 to control homocysteine metabolism in those with elevated levels.
- Calcium and Vitamin D for people (especially the elderly) who do not consume adequate amounts of dairy food.
- Iron in female vegetarians who have low haemoglobin or those who are being treated for iron deficiency anaemia.
- Iron and / or vitamin B12 in vegans to prevent or treat anaemia.
- Certain medical conditions such as cystic fibrosis or celiac disease may necessitate the therapeutic administration of large doses of certain nutrients due to a diminished ability to absorb them. Some elderly people may also need B12 supplements due to a diminished capacity to absorb it as a result of low gastric acidity.
- Large therapeutic doses of certain vitamins may be of use in treating certain medical conditions (eg, niacin for high cholesterol, Vitamin B6 for carpal tunnel) however are generally less effective than other pharmacological treatments.

Is poor nutrition a problem?

Given this information, one may reasonably ask why the prevalence of dietary related diseases is so significant if the population is obtaining adequate levels of vitamins and minerals. To put it simply, there is a lot more to good nutrition than just vitamins and minerals. Too many people's diets are excessively high in unused energy, saturate fats, salt and added sugar, whilst not contain-

ing adequate levels of fruit, vegetables and whole grains.¹¹

Why are plant foods so protective?

Population studies have revealed that diets high in whole grains, fruits and vegetables significantly decrease the risk of many diseases such as cardiovascular disease^{15,16}, type 2 diabetes^{16,17} and certain cancers.^{18,19} Precisely what substances in these foods that are responsible for their protective effect has been the subject of much investigation. Following this line of thought, however, has thus far led researchers to no certain conclusion.

For example; a lower incidence of lung cancer was observed among high consumers of carrots as well as other red and orange coloured vegetables in population studies.²⁰ These foods are known to be rich in carotenoids, most notably beta-carotene; a precursor form of vitamin A. Because beta-carotene possesses significant anti-carcinogenic activity in laboratory studies,²¹ it was assumed that it was the beta-carotene in these veggies that was responsible for the apparent protection against lung cancer.

This led to several large clinical trials which involved giving either a placebo or a large dose of beta-carotene to high risk subjects for several years.²²⁻²⁴ The combined results of these trials was adequately summed up by the authors of *Physicians Desk Reference for Nutritional Supplements*⁵⁴, which states:

...three other large intervention studies in normally nourished subjects, long-term smokers, former smokers and those exposed to asbestos found no overall benefit from high-dose beta-carotene. Moreover, in one of these studies, there was a significant 18% excess incidence of lung cancer among those who received beta-carotene supplements.

Evidently, whatever the substance in carrots and carotenoid-rich vegetables was that was protecting people against lung cancer was not the beta-carotene. So what was it?

Phytochemicals

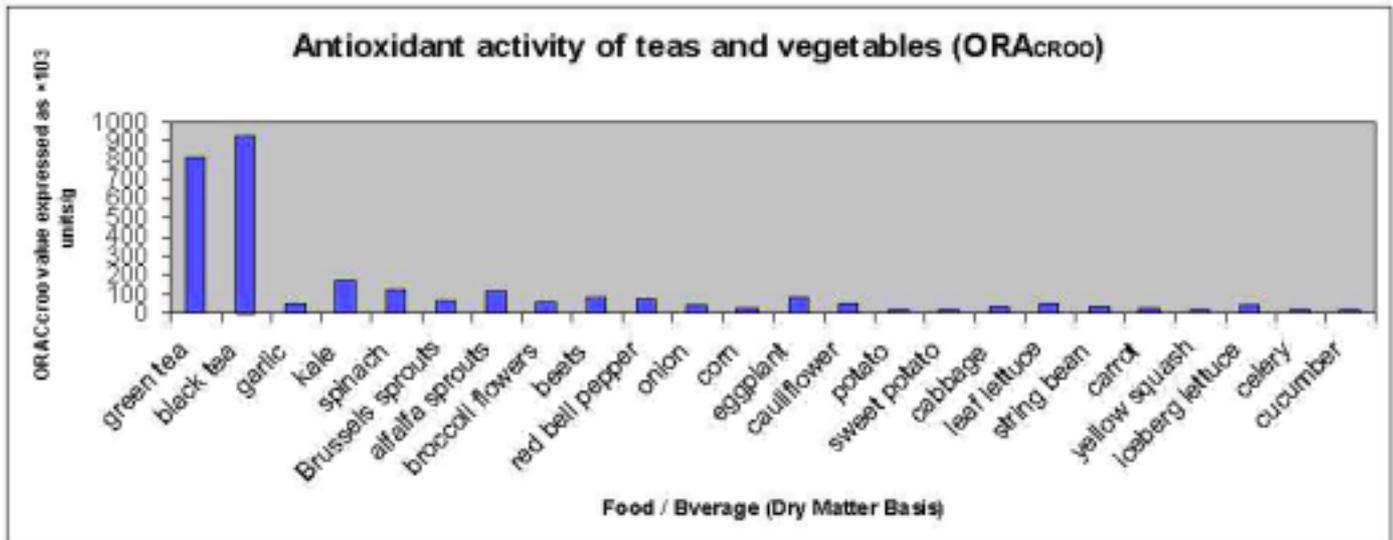
Ultimately, it is not known what substances in plant foods are responsible for their protective effect; clinical trials testing individual nutrients in the treatment or prevention of cancer and heart disease have generally resulted in disappointing outcomes. There are potentially hundreds, if not thousands, of substances present in plant foods referred to as 'phytochemicals'. Many phytochemicals have been identified as having various protective effects including protection against cancer;²⁵ however there are several factors that need to be considered:

1. There are far too many phytochemicals to study; some of them may not have even been identified yet.
2. There are far too many of them to simply put into a supplement pill.
3. Most importantly, the beneficial effect that consumption of plant foods have, more than likely comes from consuming the combinations of many phytochemicals found in fruits and vegetables, rather than just a small handful of them found in supplements.²⁶

Consequently, taking supplemental doses of only a small number of these phytochemicals is a poor substitute for eating plant foods. We may never identify the specific phytochemicals or combinations of phytochemicals responsible for the cardioprotective and chemoprotective effects that fruit and vegetable consumption has demonstrated in population studies. Put simply, if you want the protective effect of eating fruits, vegetables and whole grains, you have to eat them — there is no other way.

Juicing

It is also important to note than many of the beneficial substances present in plant foods are found in their skins and fibrous content/roughage.^{27,28} Consequently, drinking fruit and vegetables juices, whilst providing some phytochemicals, is a



Cao G, Sofic E, Prior R. Antioxidant capacity of tea and common vegetables. *J Agri Food Chem* 44: 3426-3431, 1996.

poor substitute for eating them whole, and generally provides a very dense source of sugar.²⁹

Antioxidants – not all are equal

Antioxidants have become a much talked about issue in the media. Antioxidants help to defend against free radicals which disrupt DNA, oxidize lipids and damage cell membranes — all factors that contribute towards the causation of both cancer³⁰ and cardiovascular disease.³¹ Unfortunately, there are two factors that need to be considered in regards to antioxidants. The first is that there is a lot more involved in the pathogenesis of these diseases than simply free radical attack.³² The second is that whilst various plant foods provide substances that do possess significant antioxidant activity, the same substances also possess a plethora of other actions that help defend against disease. Substances whose only mechanism of action is an antioxidant one may help to defend against free radicals, but may not help to defend against the many other factors involved in the development of these diseases.

To give an example, it is known that large supplemental doses of the antioxidant vitamin alpha-tocopherol (vitamin E) decreases the susceptibility to low-density lipoprotein (LDL) 'bad' cholesterol oxidation (which is a significant contributing factor in the pathogenesis of coronary heart dis-

ease).³³ Population studies have revealed that diets high in vitamin E rich foods such as nuts,³⁴ olive oil³⁵ and whole grain cereal foods¹⁶ significantly decrease the risk of heart disease. Despite these observations, large well-designed clinical trials have generally failed to find any reduction in the incidence of heart attacks between subjects given vitamin E supplements, and those given a placebo over several years.³⁶

To give another example, this time using cancer as the model; it is well known that tea, particularly green tea, possesses a very potent antioxidant action (far greater than that of vitamin E). The graph below compares the antioxidant activity of tea with various vegetables.³⁷

Despite having such a powerful antioxidant activity, the majority of well designed population studies have found little if any significant reduction in the risk of cancer among drinkers of both green and black tea.³⁸⁻⁴² On the other hand, a majority of well designed population studies have demonstrated a significant reduction in the risk of cancer¹⁸ and cardiovascular disease¹⁵ associated with higher intakes of fruits and vegetables, despite having an antioxidant action considerably less powerful than tea. It is important to understand that many of the substances found plant foods such as whole grains⁴³ fruits vegetables⁴⁴ (and even tea⁴⁵) also possess a wide range

of protective mechanisms, only one of which is an antioxidant action.

Antioxidant Nutrients

Unfortunately, some people may be under the impression that taking large doses of certain antioxidants may be all that is required to help protect against diseases such as cancer. Vitamins C, E, beta-carotene and Selenium are all essential nutrients, and all possess an antioxidant activity. Due to their antioxidant activity, it was thought that they may help to defend against cancer.

In 2004, a review of 14 clinical trials involving more than 170,000 people published in *The Lancet*, found antioxidant vitamins C, E and beta carotene offered no protection against cancer.⁴⁶ This study provided strong evidence that antioxidant vitamin supplements are not effective in protecting against cancer. It was of concern to note that this review found a small increase in mortality among people taking antioxidants compared with those given a placebo.

Vitamin and Mineral Supplements – The bottom line

Population studies have found strong evidence that higher consumption of plant foods such as fruits, vegetables and whole grains can significantly decrease the risk of serious diseases such as cardiovascular disease, diabetes and certain

cancers. It is not known precisely what substances in these foods are responsible, as there are so many of them; many having a diverse range of potentially protective biochemical mechanisms. Whilst they are good sources of vitamins and minerals, most people can, and do, get enough vitamins and minerals from their diets, and do not need additional doses in the form of supplements. Additionally, while plant-foods do contain substances that have an antioxidant activity, they also possess various chemoprotective and cardioprotective mechanisms that antioxidant vitamins do not. Based on the available data, it is recommended that we consume at least two serves of fruit and five serves of vegetables per day, as well as replacing refined grain foods with whole grain foods and including several serves of legumes per week.⁴⁷

As stated previously: if you want the beneficial effect of fruits and vegetables, you have to eat them — there is no other way.

What about other supplements?

Although many of the most popular dietary supplements contain vitamins and minerals, the other types of supplement products available on the shelves in health food stores sold as 'listed therapeutic goods' are classified as 'functional food' supplements, or herbal medicines; not all of which are entirely worthless.

Functional Food Supplements

Although their efficacy in the treatment of acute or chronic medical conditions may be limited (their use is probably more effective in combination with other treatments), certain 'functional food' supplements may be of value as an addition source of functional nutrition, thus potentially contributing towards disease prevention. Although the discussion regarding the use of these supplements lies beyond the scope of this article, suffice to say, that many

of these supplements may be of some worth, but are generally poor [and expensive] substitutes for the foods they are replacing. Briefly, some examples include:

Fish Oil — Higher consumption of fish is associated with a decreased risk of cardiovascular events, asthma and cognitive/behavioural problems, presumably due to the Omega 3 fatty acids DHA and EPA. Clinical trials have demonstrated that fish oil supplementation may be an effective treatment for some of these problems.⁴⁸ Fish however is also a rich source of vitamin D and selenium which fish oil supplements are not.



Popping supplement pills is a poor substitute for a healthy diet
Photo courtesy of Chi Tan, with thanks.

Garlic — Garlic is truly a healthy vegetable which may decrease the risk of gastro-intestinal cancers,⁴⁹ however garlic is only one of many healthy vegetables; consequently, it only replaces one of them. Garlic supplementation has demonstrated modest alterations on a number of cardiovascular disease 'risk factors'⁵⁰, however has yet to demonstrate a decrease in actual cardiovascular events (ie, heart attacks or strokes).

Flax seed oil — Flax seed is a rich source of phytoestrogens, lignans and essential fatty acids; all which contribute towards its healthful effects. Flax seed oil, however, is a poor substitute because most of the beneficial effect is due to the substances present in the fibrous flax seeds, not just in its oil.⁵¹

Grape Seed Extract — Grape seeds are a rich source of antioxidant phytochemicals which may possess a range of cardioprotective mechanisms. Thus far, however, most of the evidence to support this notion comes from laboratory studies.⁵²

Green Tea Extract — Green tea may have some healthful benefits, however, at least some of that benefit comes from being absorbed in the mouth and present in the saliva — something which does not occur upon administration of a green tea extract capsule.⁵³

Probiotic Supplements — Preliminary evidence from clinical trials have demonstrated a range of potential medicinal uses of lactic acid bacteria supplements, however more research is needed.⁵⁴

Plant sterols, stanols and wax alcohols — These substances are extracted from plants and are used in therapeutic doses to treat high cholesterol levels (hyperlipidaemia). They are especially effective in combination with statin drug therapy. They are usually added to foods such as margarine, however are available as supplements as well. Despite their efficacy in cholesterol lowering, whether they decrease the risk of heart attacks is yet to be adequately demonstrated in well designed clinical trials.^{55,56}

Glucoamine and Chondroitin — Glucosamine sulphate and Chondroitin sulphate are not exactly dietary supplements, because they do not supplement anything that would naturally occur in our diet, and are therefore more like a drug or medicine. They do appear to be more effective than a placebo in the treatment of osteo-arthritis.⁵⁷

Vegetable Juice Extract Supplements — Generally provided as powders, they are usually made of the solidified extracts of vegetable juice. The health benefits of these supplements are most likely comparable to that of juicing.⁵⁸

Money Down the Toilet

Psyllium Husk — Usually consumed as a powder, psyllium husk is often used as a fibre supplement. As is the case with other foods rich in soluble fibre, preliminary evidence suggests that in significant quantities, psyllium husk may be effective in the treatment of chronic constipation⁵⁹ and may lower serum cholesterol and glucose levels.⁶⁰

Herbal Medicines — A significant portion of the products found in health food stores are not dietary supplements but herbal medicines. The difference between a dietary supplement and an herbal medicine is that a dietary supplement is designed as just that — a supplement for a food or nutrient. That is, they provide approximate levels of that food that would be obtained from dietary sources. Herbal medicines are either derived from plants which are not intended to be eaten, or are made from highly concentrated extracts of certain foods, which provide levels not normally provided by dietary means. Dietary supplements are generally meant to substitute a component of a diet, whereas herbal medicines are specifically meant for medicinal purposes — that is, they are used to treat specific medical conditions.

Of course, there is some overlap in this definition, as many products sold as herbal medicines are simply extracts of a food designed to provide a high-dose supplemental form of that food — garlic being a typical example. Additionally, many herbal medicines can be taken as an infusion or tea, in which case, although they are being used for medicinal purposes, they are contributing to one's diet. Consequently, there is not a clear-cut definition, as some overlap exists between dietary/nutritional supplements, functional food supplements and herbal medicines.

It should be noted that herbal medicines designed for medicinal purposes often come from plants which are not meant to be consumed ordinarily, and although they may be 'natural', they can contain highly concentrated extracts of

pharmacologically active substances. Consequently, they are acting as a drug, and should be treated with the same precautions as a drug. Many can have unfavourable side effects or can react adversely with other medications. Some can also be toxic if not used correctly. Whilst there are a few herbal medicines which have been thoroughly studied, many have not been, so available information is often based on anecdotal accounts or 'traditional' uses. Although some herbs have demonstrated efficacy in managing certain diseases, they are generally not the best choice for primary pharmacological treatment.⁶¹

More Information

If you would like some reliable information on specific dietary supplements or herbal medicines, here are some good websites:

Sloan Kettering — About herbs, botanicals and other products. This website provides some good reviews of the scientific data available on various herbs and dietary supplements. Available at: www.mskcc.org/mskcc/html/11570.cfm

PDR — Physicians Desk Reference. This website has some good reviews on nutritional supplements, however its information on herbal medicines is unreliable, as it is based largely on 'traditional' uses instead of scientific evidence. Available at: www.pdrhealth.com

Medline Plus: Herbs and Supplements. — Provides scientific reviews on various popular herbs and supplements, and is published by the National Institute of Health's National Library of Medicine. Available at: www.nlm.nih.gov/medlineplus/druginfo/herb_All.html

HerbMed — Provides collations of scientific literature available for various herbal medicines, however does not cover all herbs, and some require payment to access. Available at: www.herbmed.org

Quackwatch — Excellent, scientifically accurate, information on

various forms of complementary and alternative medicine including some supplements. Available at: www.quackwatch.org

References

- [1] Parliament of Victoria Social Development Committee. Inquiry into alternative medicine and the health food industry. 1986
- [2] MacLennan, A.H., Wilson, D.H., Taylor, A.W. Prevalence and cost of alternative medicine in Australia. *Lancet* 1996; 347:569-573
- [3] MacLennan AH, Wilson DH, Taylor AW. The escalating cost and prevalence of alternative medicine. *Prev Med.* 2000;35:166-73
- [4] "Dead Doctors" doesn't die. National Council Against Health Fraud *Newsletter* 1998; 21(1) Available at: www.ncahf.org/nl/1998/1-2.html
- [5] Australian Institute of Health & Welfare. *Apparent Consumption of Nutrients Australia 1997-1998*. Canberra. December 2000
- [6] *Composition of foods, Australia* (Volumes 1-7) 1989-95 (various authors). Canberra:AGPS.
- [7]. National Food Authority 1995. NUTTAB95 database. Canberra : National Food Authority.
- [8]. English, R. & Lewis, J. *National Values of Australian Foods*. 2001; Australia New Zealand Food Authority.
- [9]. McCance and Widdowson's *The Composition of Food*. 6th Ed . 2002; Food Standards Agency, Royal Society Of Chemistry
- [10]. United States Department of Agriculture. *National Nutrient Database for Standard Reference*, Release 16-1
- [11]. Australian Bureau of Statistics. *National Nutrition Survey: Nutrient Intakes and Physical Measurements*. 1995; Australia.
- [12] National Health & Medical Research Council. *Recommended Dietary Intakes for use in Australia*; 1999 Canberra.
- [13] *Dietary Reference Intakes for Vitamin C, Vitamin E, Selenium, and Carotenoids* 2000; National Academy Press. Washington, D.C.
- [14] Hendler SS, Rorvick D. *PDR for Nutritional Supplements*. Medical Economics Company. 2001; Montvale, NJ:
- [15] Ovesen LF. Increased consumption of fruits and vegetables reduces the risk of ischemic heart disease *Ugeskr Laeger*. 2005;167:2742-2747.
- [16] Liu, S. Intake of refined carbohydrates and whole grain foods in relation to risk of type 2 diabetes mellitus and coronary heart disease. *J Am Coll Nutr*. 2002;21:298-306.
- [17] Riccardi G, Capaldo B, Vaccaro O. Functional foods in the management of

obesity and type 2 diabetes. *Curr Opin Clin Nutr Metab Care*. 2005;8:630-635.

[18] Riboli E, Norat T. Epidemiologic evidence of the protective effect of fruit and vegetables on cancer risk. *Am J Clin Nutr*. 2003;78:559S-569S.

[19] Jacobs, D. R., Slavin, J., and Marquart, L. Whole grain intake and cancer: A review of the literature *Nutr Cancer*. 1995;24:221-299

[20] Goodman GE. Prevention of lung cancer. *Crit Rev Oncol Hematol* . 2000;33:187-197.

[21] Dragnev KH, Rigas JR, Dmitrovsky E. The retinoids and cancer prevention mechanisms. *Oncologist*. 2000;5:361-368.

[22] The Alpha-Tocopherol, Beta Carotene Cancer Prevention Study Group. The effect of vitamin E and beta-carotene on the incidence of lung cancer and other cancers in male smokers. *N Engl J Med* . 1994; 330:1029-1035.

[23] Omenn GS, Goodman GE, Thornquist MD, et al. Effects of the combination of beta carotene and vitamin A on lung cancer and cardiovascular disease . *N Engl J Med* 1996; 334:1150-1155.

[24] Hennekens CH, Buring JE, Manson JE, et al. Lack of effect of long-term supplementation with beta carotene on the incidence of malignant neoplasms and cardiovascular disease. *N Engl J Med*. 1996; 334:1145-1149.

[25] Nishino H, Murakoshi M, Mou XY, Wada S, Masuda M, Ohsaka Y, Satomi Y, Jinno K. Cancer prevention by phytochemicals. *Oncology*. 2005;69:38-40

[26] Suter PM, Moser C. Fruit and vegetable *Ther Umsch*. 2005;62:607-610.

[27] Boyer J, Liu RH. Apple phytochemicals and their health benefits. *Nutr J*. 2004;3:5

[28] Monagas M, Hernandez-Ledesma B, Gomez-Cordoves C, Bartolome B. Commercial Dietary Ingredients from *Vitis vinifera* L. Leaves and Grape Skins: Antioxidant and Chemical Characterization. *J Agric Food Chem*. 2006 ;54:319-327.

[29] USDA National Nutrient Database for Standard Reference, Release 16-1 USDA *National Nutrient Database for Standard Reference*, Release 16-1 Sugars, total (g). Content of Selected Foods per Common Measure, sorted alphabetical

[30] Valko M, Rhodes CJ, Moncol J, Izakovic M, Mazur M. Free radicals, metals and antioxidants in oxidative stress-induced cancer. *Chem Biol Interact*. 2006; Jan 20

[31] Violi F, Cangemi R. Antioxidants and cardiovascular disease. *Curr Opin Investig Drugs*. 2005;6:895-900.

[32] Underwood, J.C.E. *General and Systemic Pathology*, 4th Ed. 2004; Churchill Livingstone, London

[33] Porkkala-Sarataho EK, Nyyssonen

MK, Kaikkonen JE, Poulsen HE, Hayn EM, Salonen RM, Salonen JT. A randomized, single-blind, placebo-controlled trial of the effects of 200 mg alpha-tocopherol on the oxidation resistance of atherogenic lipoproteins. *Am J Clin Nutr*. 1998;68:1034-1041

[34] Kris-Etherton PM, Zhao G, Binkoski AE, Coval SM, Etherton TD. The effects of nuts on coronary heart disease risk. *Nutr Rev*. 2001;59:103-111.

[35] Panagiotakos DB, Pitsavos C, Polychronopoulos E, Chrysohoou C, Zampelas A, Trichopoulos A. Can a Mediterranean diet moderate the development and clinical progression of coronary heart disease? A systematic review *Med Sci Monit*. 2004;10: 193-198

[36] Jialal I, Devaraj S. Scientific evidence to support a vitamin E and heart disease health claim: research needs. *J Nutr*. 2005;135:348-53.

[37] Prior RL, Cao G. Antioxidant capacity and polyphenolic components of teas: implications for altering in vivo antioxidant status. *Proc Soc Exp Biol Med*. 1999;220:255-261.

[38] Seely D, Mills EJ, Wu P, Verma S, Guyatt GH. The effects of green tea consumption on incidence of breast cancer and recurrence of breast cancer: a systematic review and meta-analysis. *Integr Cancer Ther*. 2005;4:144-155.

[39] Hoshiyama Y, Kawaguchi T, Miura Y, Mizoue T, Tokui N, Yatsuya H, Sakata K, Kondo T, Kikuchi S, Toyoshima H, Hayakawa N, Tamakoshi A, Yoshimura T; JACC Study Group. Green tea and stomach cancer—a short review of prospective studies. *J Epidemiol*. 2005;15:S109-112.

[40] Borrelli F, Capasso R, Russo A, Ernst E. Systematic review: green tea and gastrointestinal cancer risk. *Aliment Pharmacol Ther*. 2004;19:497-510.

[41] Arab L, Il'yasova D. The epidemiology of tea consumption and colorectal cancer incidence. *J Nutr*. 2003;133:3310S-3318S.

[42] Sun CL, Yuan JM, Koh WP, Yu MC. Green tea, black tea and breast cancer risk: a meta-analysis of epidemiological studies. *Carcinogenesis*. 2005 Nov 25;

[43] Slavin JL, Martini MC, Jacobs DR Jr, Marquart L. Plausible mechanisms for the protectiveness of whole grains. *Am J Clin Nutr*. 1999;70:459S-463S.

[44] Steinmetz KA, Potter JD. Vegetables, fruit, and cancer prevention: a review. *J Am Diet Assoc*. 1996;96:1027-39.

[45] Lambert JD, Yang CS. Mechanisms of cancer prevention by tea constituents. *J Nutr*. 2003;133:3262S-3267S.

[46] Bjelakovic G, Nikolova D, Simonetti RG, Gluud C. Antioxidant supplements for prevention of gastrointestinal cancers: a

systematic review and meta-analysis. *Lancet*. 2004;364:1219-1228.

[47] National Health and Medical Research Council. *Dietary Guidelines for Australian Adults*. Canberra.

[48] Oh, R. Practical applications of fish oil (Omega-3 fatty acids) in primary care. *J Am Board Fam Pract*. 2005;18:28-36.

[49] Fleischauer AT, Arab L. Garlic and cancer: a critical review of the epidemiologic literature. *J Nutr*. 2001;131:1032S-1040S.

[50] Spigeliski D, Jones PJ. Efficacy of garlic supplementation in lowering serum cholesterol levels. *Nutr Rev*. 2001;59:236-241.

[51] Bloedon LT, Szapary PO. Flaxseed and cardiovascular risk. *Nutr Rev*. 2004;62:18-27.

[52] Bagchi D, Sen CK, Ray SD, Das DK, Bagchi M, Preuss HG, Vinson JA. Molecular mechanisms of cardioprotection by a novel grape seed proanthocyanidin extract. *Mutat Res*. 2003;523-524:87-97.

[53] Yang CS, Lee MJ, Chen L. Human salivary tea catechin levels and catechin esterase activities: implication in human cancer prevention studies. *Cancer Epidemiol Biomarkers Prev*. 1999;8:83-89.

[54] Senok AC, Ismael AY, Botta GA. Probiotics: facts and myths. *Clin Microbiol Infect*. 2005;11:958-966.

[55] Gylling H, Miettinen TA. The effect of plant stanol- and sterol-enriched foods on lipid metabolism, serum lipids and coronary heart disease. *Ann Clin Biochem*. 2005;42:254-63.

[56] Chen JT, Wesley R, Shamburek RD, Pucino F, Csako G. Meta-analysis of natural therapies for hyperlipidemia: plant sterols and stanols versus policosanols. *Pharmacotherapy*. 2005;25:171-183.

[57] Richey F, Bruyere O, Ethgen O, Cucherat M, Henrotin Y, Reginster JY. Structural and symptomatic efficacy of glucosamine and chondroitin in knee osteoarthritis: a comprehensive meta-analysis. *Arch Intern Med*. 2003;163:1514-1522.

[58] Barrett, S. Juicing quackwatch.org/01QuackeryRelatedTopics/juicing.html Juice Plus: A Critical Look [www.nlmwatch.org/04C/NSA/juiceplus.html]

[59] Krammer H, Schlieger F, Singer MV. Therapeutic options of chronic constipation. *Internist (Berl)*. 2005;46:1331-1338.

[60] Sierra M, Garcia JJ, Fernandez N, Diez MJ, Calle AP. Therapeutic effects of psyllium in type 2 diabetic patients. *Eur J Clin Nutr*. 2002;56:830-842.

[61] Ernst, E. Herbal medicines put into context. *BMJ*. 2003;327:881-882

