

Cruciferous Vegetables and Thyroid Function

Goitrogens and EnduraCell®

BACKGROUND INFORMATION For many years, it has been known that compounds called *goitrogens* can interfere with the normal function of the thyroid gland, preventing the incorporation of iodine into the hormones the thyroid gland produces. Such *goitrogenic compounds* are found in certain cruciferous vegetables. This has led to widespread confusion because it has been assumed by many (including clinicians) that all cruciferous vegetables are equally *goitrogenic*. This is not the case.

HOW DO GOITROGENS FORM? Progoitrins are precursors to the *goitrins*. In the case of broccoli, the progoitrins develop as the vegetable matures and are virtually non-detectable in the seed or sprout but increase as the vegetable grows to maturity. For the *progoitrin* to convert to the *goitrin*, it needs to be converted by activation of an enzyme known as *myrosinase* and found in the plant cell. If broccoli or the other crucifers are cooked, the myrosinase enzyme is destroyed and the *goitrins* aren't produced.

BROCCOLI SPROUTS ARE NON-GOITROGENIC Of the various cruciferous vegetables, broccoli in fact is not particularly high in these goitrogenic substances and when it is cooked, absence of active myrosinase enzyme means that there are no *goitrins* produced. Because broccoli is usually eaten cooked, there is really no need for concern regarding thyroid function. Where the sprout is concerned, **EnduraCell®** as a sprouted broccoli product is produced to ensure retention of the *myrosinase* enzyme but because the progoitrins are virtually absent, there is no risk of compromising thyroid function in this way.

BEWARE OF RAW KALE On the other hand, kale is very high in *progoitrins*, increasing the risk of thyroid dysfunction (See Table 1 below). The popular trend of juicing kale is a practice which puts a consumer at significant risk of thyroid dysfunction, especially if dietary iodine intake is low. (This is one of the reasons we include iodine in our DefenCell® formulation; iodine deficiency is very common outside communities who consume large amounts of seaweed). If you wish to consume kale, cook it to destroy the enzyme – but don't juice it raw!

OTHER CRUCIFERS TO AVOID EATING RAW Of the identified *progoitrin*-containing young germinated crucifers, Brussels sprouts, kale and several of the Asian vegetables are the highest. Even though we have been able to quantify *progoitrin* in significant numbers of crucifers, a threshold for thyrotoxicity in humans has not been determined. Because EnduraCell® is manufactured from sprouted broccoli, its *progoitrin* content is insignificant, so there is no risk to your patients of consuming EnduraCell® supplements even in the higher doses sometimes required for certain clinical conditions.

Quantification of sulforaphane-yielding glucosinolates and goitrogenic substances in seeds and sprouts of cruciferous vegetables

Glucosinolate	Red radish	Daikon	Broccoli	Kohlrabi	Garden cress	Rocket	Kale	Water cress	Chinese broccoli	Cabbage	Choy sum	Mizuna	Senposai	Red giant mustard	Pak choy	Black mustard	Japanese turnip	Broccoli rabe	Taipei	Chinese cabbage	Komatsuna	White mustard	Wasabi	
Glucoraphanin		6.5	333.6	86.0		10.4	31.9				3.2	5.3	5.4		8.9					3.7				
Progoitrin				6.5			18.5				14.5	2.9	97.6		9.2		2.8	3.4	1.7	10.6	1.1			

Table 1. Glucosinolate composition and concentration ($\mu\text{mol/g}$) of seeds of Asian and Western vegetables. (glucosinolates in italics are presented as $\mu\text{mol sinigrin equivalent/gFW}$)

NOTES:

- Glucoraphanin** is the precursor compound present in large amounts in sprouted broccoli and which, under the enzymatic hydrolysis of the myrosinase enzyme, yields **sulforaphane**, the bioactive compound extensively studied for its chemopreventive effects.
- Progoitrins** under the effects of the same enzyme, myrosinase yield **goitrins**, the compounds shown to have adverse effects on thyroid function, especially if iodine status is inadequate. Broccoli sprouts do not contain progoitrins but these can develop as the plant matures as a vegetable.
- When crucifers are cooked, the myrosinase enzyme is destroyed, so that there is no production of either sulforaphane from glucoraphanin-containing vegetables or goitrins from progoitrin-containing vegetables.
- Consumption of raw broccoli** or broccoli sprouts wherein myrosinase remains intact yields beneficial sulforaphane and no goitrogenic substances.
- Consumption of raw kale** and especially kale juice yields potentially-thyrotoxic goitrins. Some Asian vegetables, *Senposai* and *Choy sum* pose even greater risk than does *kale* if consumed raw.

Table adapted from: Tim J. O'Hare and Lung S. Wong Department of Primary Industries and Fisheries, Gatton Research Station, LMB7, MS437 Gatton 4343 Queensland, Australia. & Donald E. Irving School of Agronomy and Horticulture University of Queensland Gatton 4343 Queensland, Australia. *Asian and Western Vegetables of the Brassica Family with Anti-cancer Potential*. September, 2004. Page 19 of 47.