

Spanish Black Radish (*Raphanus sativus* L. var. *niger*) and Detoxification in Mice

Based on the paper: Spanish Black Radish (*Raphanus sativus* L. var. *niger*) Diet Enhances Clearance of DMBA and Diminishes Toxic Effects on Bone Marrow Progenitor Cells.
N'jai AU, Kemp MQ, Metzger BT, Hanlon PR, Robbins M, Czuyprynski C, Barnes DM.
2012. *Nutrition and Cancer*. 64(7):1038-48.



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Spanish Black Radish (*Raphanus sativus* L. var. *niger*) and Detoxification in Mice

- › 96 mice
- › Two diets: control and 20 percent Spanish black radish
- › Exposed to a purified toxin also found in char-grilled foods



- › Phase one and two enzyme expression increased in mice consuming the diet containing Spanish black radish.
- › Six hours after exposure, concentrations of a toxin were 47 percent lower in the blood of mice consuming Spanish black radish than in the control mice.
- › In the group fed Spanish black radish, bone marrow stem cell counts were less affected and showed a faster recovery compared to the control group mice.

After investigating Spanish black radish extracts in liver cells¹ and the chemical makeup of this cruciferous vegetable^{2,3} in detail, Standard Process scientists, in collaboration with researchers at the University of Wisconsin-Madison, designed a study to explore how consumption of this radish affects detoxification in a whole-animal model.

This study evaluated three steps of detoxification:

- › How inclusion of Spanish black radish in a mouse diet influences phase one and two detoxification gene expression
- › How fast a toxin is cleared from the blood
- › If bone marrow stem cells are protected by dietary inclusion of Spanish black radish

Ninety-six mice were split into two groups—one received a control diet and the other received a diet composed of 20 percent Spanish black radish (SBR) organically grown on the Standard Process Farm. While 20 percent may sound like a lot, the United States Department of Agriculture suggests that, for humans, 50 percent of the food on our plate should be fruits and vegetables. Theoretically, then, 25 percent of our consumption could come from cruciferous vegetables like radishes, broccoli, and kale.

The diets were fed to the mice for two weeks.

Liver tissue from the mice showed that in the group consuming Spanish black radish, four of the nine detoxification enzymes tested showed a statistically significant increase.

1. *J Agric Food Chem*, 2007, 55(16):6439-46.
- › *Spanish black radish increased activity of phase one and two detoxification enzymes in the human hepatoma HepG2 cell line.*
2. *J Food Sci*, 2011, 76(1):C185-92.
- › *Eight radish varieties were evaluated for phytochemical composition/biological activity; the antioxidant-response-element activity of radish sprouts and mature taproots was significantly correlated with the total isothiocyanate concentration of the radishes.*
3. *J Food Sci*, 2011, 76(3):C504-11.
- › *Raphasatin, the primary a glucosinolate metabolite of Spanish black radish, induces detoxification enzymes in mice.*

In Mice Consuming Diet With 20% Spanish Black Radish (SBR)			
	SBR	Control	
Phase One Enzymes	CYP1A1	○	●
	CYP1A2	○	●
	CYP1B1	●	●
	CYP2E1	●	●
	Ephx1	○	●
Phase Two Enzymes	Gsta2	○	●
	Hmox1	●	●
	Qr	●	●
	Txrd1	●	●

○ Significant increase

● No significant increase

But because gene expression may not translate into actual enzyme activity, the researchers also examined how quickly the toxin was cleared from the blood.

Both the control group and the group consuming Spanish black radish were exposed to a toxin found naturally in char-grilled foods, the polycyclic aromatic hydrocarbon dimethylbenz(a)anthracene (DMBA).⁴ Using a dose of 10 mg/kg of DMBA, researchers evaluated how quickly the toxin was cleared from the blood. **They report that at the sixth hour, toxin concentrations were 47 percent lower in the blood of mice consuming the Spanish black radish compared to the control mice.**

After examining gene expression and enzyme activity, researchers wanted to measure the level of actual protection provided by these factors. Because bone marrow stem cells are particularly vulnerable to DMBA, they were a perfect choice. Mice were treated with both the 10 mg/kg dose and a higher dose of the toxin (50 mg/kg). Then their bone marrow cells were counted starting at six hours post-treatment.

The scientists report that at six hours post-treatment, the bone marrow stem cells of the Spanish black radish group were less affected by either the high or low dose of DMBA. And total cell counts at 48 hours had rebounded significantly in the Spanish black radish group compared to the control mice, suggesting a faster recovery from the toxin exposure.

This peer-reviewed paper brings together many years of Standard Process research on the Spanish black radish and shows that in mice, this vegetable can increase both phase one and two detoxification enzymes, leading to faster clearance of DMBA and better protection for bone marrow stem cells.

Background

Population studies associate consumption of cruciferous vegetables with improved health. One reason for this may be due to a class of phytonutrients called glucosinolates, which increase the expression of liver enzymes responsible for detoxification of toxins. Some chemicals can't be removed via the kidneys like other toxins. Because of this, the toxin goes to the liver first and is altered by phase one enzymes. Unfortunately, that process allows the toxin to be reactive and possibly damage a cell's DNA. So phase two enzymes interact with the altered toxin to prevent it from attaching to our DNA during elimination.

4. Environmental Protection Agency: Polycyclic Aromatic Hydrocarbons (PAHs): "You could be exposed to PAHs by ... eating meat or other foods that you grilled. Grilling and charring food actually increases the amount of PAHs in food." Accessed 10/9/12: (www.epa.gov/osw/hazard/wastemin/minimize/factshts/pahs.pdf)

