Beans, beans, the magical fruit.
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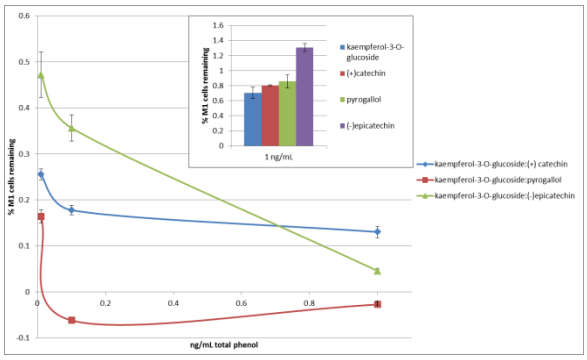
We have all heard the children's song celebrating the ability of bean consumption to induce abnormally high levels of flatulence. However, the song's advice to "have beans for every meal" could not be more celebrated, not for the juvenile thrill of clearing a small room, but for the chronic health benefits this staple crop provides.

Beans have unusually high levels of phenolic compounds, mainly in their hulls, which compares favorably to more well-known and expensive commodities such as grapes or blueberries. Many of us have heard of the many health benefits associated with resveratrol, a phenolic compound found in grape skins. Resveratrol has been linked to treating a myriad of diseases in laboratory settings including heard disease, cancer, Alzheimer's disease, and diabetes. However, these health benefits require massive doses of this compound to elicit any significant benefit. The amount of resveratrol given per dose in studies is around 200 mg/kg body weight. This is equivalent to about 2000 liters of red wine per dose. Obviously, these kinds of doses of a single compound are unrealistic for a single compound. However, when multiple compounds are used together, they can function synergistically, becoming more than the whole.

We have recently started studying the synergy of pure phenols native to dry edible beans (DEB) to elicit anti-inflammatory effects in white blood cells. This effort is designed to uncover a passive method of treating macrophage-mediated chronic inflammatory diseases. These include arthritis, heart disease, cancer, and neurodegenerative diseases among others. To date we have exciting preliminary data highlighting that some of the phenols native to pinto beans can work synergistically at very low concentrations (low nM, that is 10^{-9} M or about 0.01 mg/kg) making them suitable for use in a functional-food and perhaps clinically relevant at reasonable doses from a whole-food. Using our previous wine example, this would be like requiring 0.1 liters of wine, or about 1 glass. An example of our preliminary results is shown in the adjoining figure.



Results white blood cells treated with bean based phenols. Cells were first activated to the pro-inflammatory state (or as we refer to as the disease promoting state) washed, then subjected to phenolic incubation (1, 0.1, and 0.01 ng/mL) for 24 hours. A biomarker of inflammation was monitored [NO](µM/mg protein) and normalized to 1 to signify the pro-inflammatory state, 0 for untreated cells, and -1 for the anti-inflammatory state (or disease preventing state.) Combined the bean based phenols compounds significantly reduced the pro-inflammatory state a dose dependent manner and even was able to start the switch to the disease preventing state compared when used in isolation (refer to inset).

Here, white blood cells were exposed to isolated phenols from pinto beans. The higher the number the more pro-inflammatory the cells. When the 3 compounds are used alone there is no effect on the inflammatory response. However, when used together at a 1:1 ratio, the whiteblood cells are rescued from their pro-inflammatory state. This indicates that the phenols navive to pinto beans have a very strong anti-inflammatory effect at extremely low doses. Exactly how the phenols function together, however, has yet to be determined and is important to understand to formulate any potential clinical therapeutic interventions.

To date we have only started to scratch the surface of what beans are capable of treating. While we forge ahead using isolated compounds to understand the language they are speaking, we are also using various cultivars of DEB to determine how their phenolic composition affects white blood cells in culture and in animal studies. The ultimate objective is to create a bean high in synergistically acting phenolics as a value-added functional food.