Color is not the whole story – varieties of deep purple sweet potatoes and their health properties

Purple plant foods (e. g. purple cabbage, purple cauliflower, blueberries) contain high amounts of anthocyanins, which are antioxidants responsible for the strong blue - purple colors. There are > 500 different anthocyanin molecules, some of which have more potent antioxidant properties that can protect against diseases such as cancer. Purple fleshed sweet potatoes contain significant amounts of anthocyanin types with stronger antioxidant activity than anthocyanins from many other anthocyanin-rich plant foods.

When anthocyanins in food are consumed they are broken down to different molecules from enzymatic digestion in the stomach, small intestine and degradation by gut bacteria in the colon. The digestion generates break down molecules from anthocyanins (called metabolites) that can be absorbed to exert the health benefits of anthocyanin-rich foods. A complicating factor is that different cultivated varieties (cultivars) of anthocyanin-rich foods contain different profiles of anthocyanin molecules that will differ in the generation of beneficial metabolites following digestion. For this reason, it is important to study the types of anthocyanin metabolites produced from the digestion of different cultivars from the same plant food.


There exist different methods to examine anthocyanin metabolites produced during digestion. For example, animals or humans can be fed the food and the metabolites can be measured in blood, urine, or feces. However, these methods are very time consuming and expensive and so this is an unrealistic approach to scan for beneficial metabolites from the existing large variety of different purple plant food species and cultivars. Such approaches are also limited as to determining where the metabolites are generated in the gut. To circumvent that, digestion models have been developed to mimic human gastrointestinal digestion in a lab setting. Meals are digested in vessels containing stomach and small intestine enzymes to simulate digestion in the stomach and small intestine and these vessels are coupled with vessels containing colonic gut bacteria. Our study employed a more complex digestion model containing five vessels, each representing a different part of the intestinal tract: the stomach, small intestine and the three segments of the colon (ascending, transverse and descending colon in sequential order of digestion) as opposed to more basic 3 vessel models using stomach and small intestine vessels and one vessel for the entire colon. Our sophisticated model is more accurate because each colonic segment has its own specific pH level (acid-base balance). These colonic pH differences lead to different bacterial populations that can generate differing profiles of anthocyanin metabolites produced from anthocyanin digestion, which better represents what happens within the body.

We studied two cooked sweet potato cultivar meals in our digestion model. Samples taken from each of the gut digestion vessels were analyzed to identify anthocyanin metabolites generated during digestion. A key finding was that major differences were seen between the two sweet potato varieties in terms of where their anthocyanins were mostly digested. One variety showed the greatest number of metabolites generated from small intestine digestion whereas the digestion of the other variety produced most anthocyanin metabolites in the first stage of colonic bacterial digestion occurring in the ascending colon. It appears that different purple sweet potato cultivars have variations in other food components that could affect anthocyanin release during digestion that could affect anthocyanin metabolite absorption and therefore their health properties. For both cultivars, low quantities of anthocyanin metabolites were seen in the end stage digestion of the descending colon, which shows extensive breakdown by colonic bacterial digestion. Future work examining the antioxidant properties of the anthocyanin metabolites of each sweet potato variety from the various gut model segments could further highlight the functional health properties associated with differing anthocyanin patterns of digestion and metabolite generation.

Publication

Biotransformation of anthocyanins from two purple-fleshed sweet potato accessions in a dynamic gastrointestinal system.
Kubow S, Iskandar MM, Sabally K, Azadi B, Sadeghi Ekbatan S, Kumarathasan P, Das DD, Prakash S, Burgos G, Zum Felde T
Food Chem. 2016 Feb 1