Anti-cancer effects of cabbages: the crucial role of an intestinal bacteria

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Translated from Le Journal de Montréal, August 16th, 2020

Consuming cruciferous vegetables is associated with a lower risk of several types of cancer. According to a recent study, this protection is partly mediated by the action of a bacteria present in the intestine, which allows the formation of molecules with strong anticancer activity.

PLANT COMPLEXITY

Plants are essential for cancer prevention because they are the only foods capable of slowing the progression of microscopic tumors that form spontaneously during our life. In addition to their content in vitamins, minerals and fibers essential for health, plants also have a wide variety of phytochemical molecules which have well-defined pharmacological properties and which interfere with several phenomena essential for the appearance and progression of cancerous cells in humans.

This phytochemical arsenal is staggeringly complex: according to recent estimates, a diet rich in plants allows for the absorption of at least 26,000 distinct compounds, many of them with measurable biological activities (1). To add to this complexity, many of these molecules are transformed in the gut by the hundreds of billions of resident bacteria (the gut microbiome), which greatly influences their absorption and biochemical activity.

Overall, we can therefore see that what we eat is much more complicated than what is indicated on the nutritional labels!

ANTI-CANCER CABBAGE

Cruciferous vegetables (cabbage, broccoli, turnip, radish, arugula) are possibly one of the best examples of the impact of this plant complexity on cancer risk.

Several epidemiological studies have shown that regular consumption of these vegetables is associated with a reduced risk of several types of cancer, in particular those of the lung, bladder, prostate and breast. The importance of these vegetables is that they are the only vegetables in the diet that contain significant amounts of glucosinolates, a class of compounds which are inert, but which are transformed by an enzyme called myrosinase into powerful anticancer molecules (isothiocyanates and indoles) following the breakage of plant cells during chewing. Unfortunately, myrosinase is very sensitive to heat, so prolonged cooking of vegetables can substantially reduce the amount of isothiocyanates ingested when consuming cruciferous. It is for this reason that we usually recommend that you cook cruciferous vegetables as little as possible (quick steaming or stir-fry in a wok) to maximize their content in anticancer molecules.

REINFORCEMENT BACTERIA

A recent study suggests that certain bacteria in the gut microbiome may turn glucosinolates into isothiocyanates and thus represent a "rescue route" to compensate for the inactivation of the vegetable's enzyme caused by heat (2).

In this study, published in the prestigious journal Cell, the researchers observed that a bacteria very abundant in the human intestine (Bacteroides thetaiotaomicron) possessed a group of genes which, collectively, make it possible to transform glucosinolates into isothiocyanates. This group of genes seems sufficient to effect this transformation, because their insertion into another type of bacteria that does not normally produce isothiocyanates allowed these molecules to be generated.

This bacterial production of isothiocyanates occurs in humans: an analysis of stool samples from inhabitants of various regions of the world showed the presence of the bacterial genes responsible for the transformation in half of the participants, with the exception however of Fiji residents. Bacterial transformation of glucosinolates therefore seems to be a fairly widespread phenomenon in humans, but the variations observed in the presence of these genes suggest that certain external factors may interfere with this phenomenon, possibly by influencing the composition of the intestinal microbiome.

The production of isothiocyanates by the gut microbiome means that the anticancer activity of cruciferous vegetables is preserved even when they are cooked at temperatures that inactivate myrosinase, for example when preparing soups or baking dishes. This is also good news for the use of frozen products which undergo high temperature bleaching which inactivates myrosinase.

In short, raw, crunchy or very cooked, cruciferous vegetables are in all cases the foods of choice for cancer prevention.

(1) Barabási AL et coll. The unmapped chemical complexity of our diet. Nature Food 2020; 1 : 33-37

(2) Liou CS et coll. A metabolic pathway for activation of dietary glucosinolates by a human gut symbiont. Cell 2020; 180 : 717-728

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