How food processing can engineer the health potential of vegetables

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Brussels sprouts (*Brassica oleracea* var. *gemmifera*) and **leek** (*Allium ampeloprasum* var. *porrum*) are suppliers of multiple health-related compounds, yet understudied in terms of how different steps of the processing chain can be engineered to impact their compound concentrations.
Brussels sprouts store **glucosinolates**, which can be converted by the endogenous plant enzyme myrosinase into health-promoting isothiocyanates. Leeks contain **S-alk(en)yl-L-cysteine sulfoxides**, which can also be converted by the endogenous plant enzyme alliinase into health-promoting organosulfur components. However, these substrates and enzymes are physically separated within and between plant cells. Therefore, processing of vegetables, such as Brussels sprouts and leek, can help to fully exploit their health-potential by enabling interactions between enzymes and substrates.
In this study, the plant tissue structure was first altered by processing to direct these endogenous **enzyme-substrate interactions**. The concentrations of different water-soluble (e.g. glucosinolates, ACSOs and **vitamin C**) and lipid-soluble compounds (e.g. **carotenoids** and **vitamin K1**) were evaluated after processing both vegetables with different techniques. On the one hand, **heating** of intact vegetables prior to mixing resulted in a relatively good preservation of intrinsic compounds attributed to a prompt inactivation of the endogenous enzymes. On the other hand, **mixing** prior to heating largely facilitated enzymatic conversions. Additionally, the impact of a novel, less invasive processing method was studied: **pulsed electric field (PEF)**. This technique is able to preserve the macrostructure while altering the microstructure via electroporation. In other words, it has potential to selectively modify the microstructure while the plant tissue stays intact. It is hypothesized that through the creation of pores in cell membranes, contact between substrate and enzyme could be facilitated. Results confirmed an intermediate conversion of vitamin C and ACSOs after PEF treatment. Generally, interaction effects between health-related compounds were established as higher vitamin C concentrations seemed to have a protective effect on lipid-soluble health-related compounds against oxidation.
Finally, concentration of the health-related compounds were also evaluated through different **storage conditions** (refrigerated storage, and frozen storage above and below glass-transition temperature). It could be concluded that type of processing had a relative larger effect on the retention of health-related compounds compared to storage.