

Existing food processing classifications overlook the phytochemical composition of processed plant-based protein-rich foods

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According to existing food processing classification systems, plant-based protein-rich (PBPR) foods are often considered “ultra-processed” - and therefore perceived as unhealthy – despite their ability to provide various bioactive compounds potentially beneficial for human health. On the other hand, foods made from plant-based ingredients are often automatically considered healthier choices, regardless of their nutritional and overall biochemical content. Here, we used a non-targeted liquid chromatography – mass spectrometry metabolomics approach to analyze the impact of processing on the biochemical composition of PBPR foods (Raita et al., 2025). Our results reveal that existing food classification systems may provide questionable categories for PBPR foods without considering their overall biochemical composition including phytochemicals. This was exemplified by focusing specifically on biochemical compounds of soy-based products manufactured with various technologies and they showed no clear distinctions between processing groups in the principal component analysis based on the NOVA and Poti classification. However, the phytochemical profile obtained from the metabolomics analysis clearly distinguished the food products according to their processing technologies. In particular, the bioavailability of phytochemicals in fermented soy-based products is seemingly high, as exemplified with isoflavonoids. The products made from refined plant-based proteins contained only trace amounts of the potentially bioactive phytochemicals that can mediate beneficial health effects. Although the food processing classification systems are welcome in their attempt to guide consumers towards healthy choices, they should be improved to more accurately reflect the biochemical composition of PBPR foods.