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Evaluation of vitamin D bioaccessibility and iron solubility from test meals containing meat and/or cereals and/or legumes

Tiffany Antoine[1], Giulia Scorrano[1], Cristèle Icard-Vernière[2], Charlotte Halimi[1], Stéphane Georgé[3], Claire Mouquet-Rivier[2] and Emmanuelle Reboul[1]
[1]*Aix-Marseille Univ, INRA, INSERM, C2VN, Marseille, France,*
[2]*Nutripass, IRD, Univ Montpellier, Montpellier, France and*
[3]*Centre Technique de Conservation des Produits Agricoles, Avignon, France*

Abstract
Rethinking food systems from production to consumption, in order to provide better nutritional inputs at lower environmental cost, is a priority challenge for a sustainable future. Pulses present benefits that may improve the sustainability of our systems and diets, such as their ability to restore soils in nitrogen and their high contents in proteins, fibers and minerals. However, pulses also contain several bioactive compounds such as phytates or tannins that can negatively affect mineral absorption. Additionally, we recently showed in the laboratory that these bioactives, together with fibers and saponins, could negatively impact fat-soluble vitamin bioavailability. The objective of this study was thus to follow up vitamin D (as a model of fat-soluble vitamin) and iron (as a model of mineral) transfer to the aqueous phase of the bolus during digestion of meal containing or not pulses. To this aim, we performed *in vitro*digestion using tests meals made of beef (as a model of meat) and/or semolina (as a model of cereals) and/or chickpeas (as a model of pulses). To identify the compounds responsible for the observed effects, we also performed *in vitro*digestion using test meals made of potatoes supplemented or not in fibers, phytates, tannins and saponines. Vitamin D bioaccessibility and iron solubility were expressed as the ratio of vitamin D or iron recovered in the aqueous phase of the digestion on the total amount of vitamin D or iron recovered in the whole digesta, at the end of the digestion.

Our results showed that the presence of chickpeas within a meal induced a significant decrease of both vitamin D bioaccessibility (up to -56%, $p < 0.05$) and iron solubility (up to -28%, $p < 0.05$) compared to meals containing only meat and/or semolina. However, this effect was largely compensated for vitamin D by the fact that this vitamin was less stable (loss > 50%, $p < 0.05$) during the digestion of meal containing meat compared to meals containing only plant-based foods (i.e. semolina and chickpeas). Among the different bioactives, tannins appear to be the most deleterious regarding iron solubility, while both phytates and tannins were responsible for a decreased in vitamin D bioaccessibility.

Our results confirm that in some conditions, the presence of pulses within a meal can be deleterious regarding vitamin D and iron bioavailability. These data thus encourage research to propose dietary and technological solutions to tackle pulse negative effects on micronutrient bioavailability.

Conflict of Interest
There is no conflict of interest.