Comparative characterization of structure and digestibility of plant-based proteins in relation to processing

Project overview and outlook

Introduction

The traditional western diet is characterised by high meat consumption. This has negative effects on human health and the environment. Therefore, a transition towards a more plant-based diet is needed[1,2]. However, there is little known about the impact of this shift on various health domains[3, 4]. In addition, most plant proteins show limited functional properties due to their poor solubility[5,6]. Furthermore, plant proteins often contain antinutritional factors (ANF) such as phytic acid, tannins or oligosaccharides which reduce their bioavailability[4, 7]. This makes a detailed evaluation of plant protein in terms of their quality and functional properties essential.

Project overview

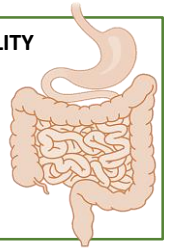
Different methods will be used to characterize the (micro) structure and bioavailability of the different model proteins coming from oat, faba bean, soy and pea.

(MICRO) STRUCTURE

Microscopy
Texture analysis
Rheology

BIOAVAILABILITY

Amino Acids
Nutrients
Antinutrients



EFFECT OF PROCESSING ON STRUCTURE & BIOAVALIABILITY

Emulsifying, Extrusion, Fermentation, Enzymatic Hydrolysis

Outlook

(MICRO) STRUCTURE -> Information on functional properties

The solubility as one key factor is essential for the gelation, emulsification and foaming ability of proteins[8,9].

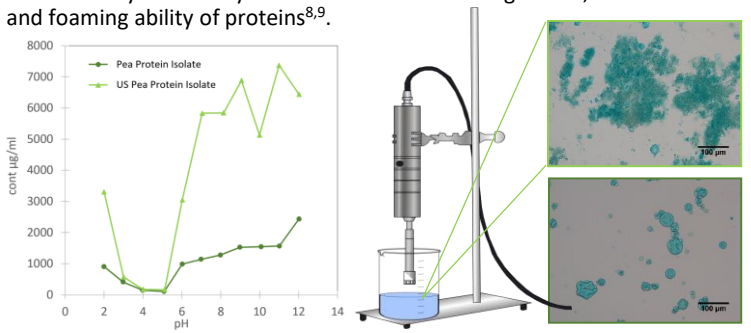


Figure 1. Solubility of pea protein isolate at different pH (left) before and after ultrasound pre-treatment (right)

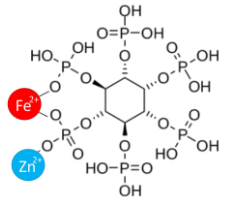


Figure 2. Phytate-mineral complex

BIOAVAILABILITY -> Information on health aspects

Phytic acid influences the functional properties of proteins[9]. However, by forming an insoluble and indigestible phytate-mineral complex, it negatively affects the bioavailability of zinc and iron[7, 10]. Characterizing the nutrients and antinutrients can give an estimation on the bioavailability of minerals.

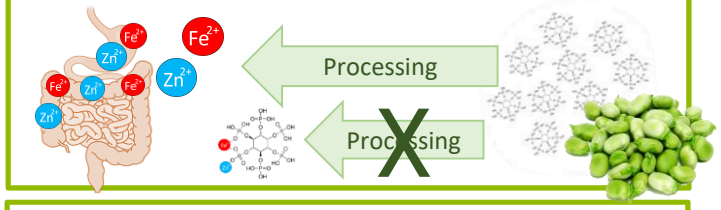
EFFECT OF PROCESSING -> Structure & Bioavaliability

Extrusion, fermentation, gelation, emulsification or enzymatic hydrolysis determine the texture of the final product[6]. In addition, some of these processes show potential to lower the number of antinutrients and can therefore improve the bioavalibilety[11,12, 13].

Figure 3. Extruded Soy

Summary & Conclusions

The characterization of plant-based proteins is essential for a shift towards a more plant-based diet. This includes the functional properties as well as the bioavailability of the raw materials. Most research has focussed on the risk of nutritional deficiencies (vitamins, minerals), especially in children, pregnant women and the elderly[3, 4]. However, processing methods like fermentation, germination, enzymatic treatments and extrusion have the potential to reduce this ANF and therefore improve their notional value[8].



References

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