Modelling of nutrient bioaccessibility in almond seeds based on the fracture properties of their cell walls.

Grassby, T 2014
Food And Function
5(12):3096-3106.

Abstract:
The cell walls (dietary fibre) of edible plants, which consist of mainly non-starch polysaccharides, play an important role in regulating nutrient bioaccessibility (release) during digestion in the upper gastrointestinal tract. Recent studies have shown that structurally- intact cell walls hinder lipid release from the parenchyma cells of almond seeds. A theoretical model was developed to predict the bioaccessibility of lipid using simple geometry and data on cell dimensions and particle size for calculating the number of ruptured cells in cut almond cubes. Cubes (2 mm) and finely-ground flour of low and high lipid bioaccessibility, respectively, were prepared from almond cotyledon. The model predictions were compared with data from *in vitro* gastric and duodenal digestion of almond cubes and flour. The model showed that lipid bioaccessibility is highly dependent on particle size and cell diameter. Only a modified version of the model (the Extended Theoretical Model, ETM), in which the cells at the edges and corners were counted once only, was acceptable for the full range of particle sizes. Lipid release values predicted from the ETM were 5.7% for almond cubes and 42% for almond flour. *In vitro* digestion of cubes and flour showed that lipid released from ruptured cells was available for hydrolysis and resulted in lipid losses of 9.9 and 39.3%, respectively. The ETM shows considerable potential for predicting lipid release in the upper gastrointestinal tract. Further work is warranted to evaluate the efficacy of this model to accurately predict nutrient bioaccessibility in a broad range of edible plants.