The role of plant cell wall encapsulation and porosity in regulating lipolysis during the digestion of almond seeds.

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Abstract:
Previous studies have provided evidence that the physical encapsulation of intracellular nutrients by cell walls of plant foods (i.e. dietary fibre) plays a predominant role in influencing macronutrient bioaccessibility (release) from plant foods during human digestion. One unexplored aspect of this is the extent to which digestive enzymes can pass through the cell-wall barrier and hydrolyse the intracellular lipid in almond seeds. The purpose of the present study was to assess the role played by cell walls in influencing the bioaccessibility and digestibility of almond lipid using a range of techniques. Digestibility experiments were performed on raw and roasted almond cells as well as isolated almond oil bodies using *in vitro* gastric and duodenal digestion models. Residual triacylglycerols and lipolysis products were extracted after 1 h of incubation and analysed by thin layer chromatography. The lipolysis kinetics of almond cells and oil bodies were also investigated using the pH-stat technique. Finally, the potential penetration of pancreatic lipase through the cell wall matrix was investigated using confocal microscopy. Differences in the rates and extent of lipolysis were clearly seen between almond cells and oil bodies, and these differences were observed regardless of the lipase(s) used. These results also showed that almond cell walls that are completely intact limit lipid digestibility, due to an encapsulation mechanism that hinders the diffusion of lipase into the intracellular environment and lipolysis products out of the cells.