

**Title** Effect of turgor on micromechanical and structural properties of apple tissue: A quantitative analysis

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### **Abstract**

The effect of turgor on the micromechanical properties of apples (*Malus domestica* Borkh. cv Jonagored) and its relation to structural parameters of the cells was investigated. Mechanical measurements were carried out using a miniature tensile stage mounted under a microscope. Turgor was manipulated by soaking tissue samples in iso-, hypo- or hypertonic mannitol solutions. Samples were then subjected to tensile and compression tests, during which the deformation of the individual cells was recorded. In both tests, sigmoidal stress–strain curves were found, where stiffness increases with strain. With increasing turgor, strain at maximum stress became significantly ( $p < 0.05$ ) lower while stiffness increased, but no clear effect on failure stress was found. As expected, fresh apples proved to be firmer and stiffer than stored apples, while the influence of turgor was the same. Measurement of initial cell parameters (area, length, width, aspect, roundness) showed that the apples in the experiment were homogeneous, having comparable cell sizes. Manipulation of turgor did not affect initial cell parameters, but the magnitude of cell deformations was clearly influenced. Larger deformations were found in flaccid cells. Changes in length and width were closely related to strain measurements. In conformity with micromechanical parameters, deformations were smaller in stored than in fresh apples.