

## عنوان مقاله:

Modeling Static Bruising in Apple Fruits: A Comparative Study, Part II: Finite Element Approach

## محل انتشار:

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## خلاصه مقاله:

**ABSTRACT-** Mechanical damage degrades fruit quality in the chain from production to the consumption. Damage is due to static, impact and vibration loads during processes such as harvesting, transportation, sorting and bulk storage. In the present study finite element (FE) models were used to simulate the process of static bruising for apple fruits by contact of the fruit with a hard surface. Three dimensional finite element models with three different layer material models were developed. The force relation between the cortex and elastic core was simulated using a gluing mechanism. An external point load simulating the wall pressure was applied on the fruit skin. The elastic, plastic and total strain energies in apple fruits were calculated to estimate mechanical bruising. In order to validate the simulated data, compression tests were carried out using a universal testing machine. Force-deformation graphs were plotted and the area of the region restricted by the curve and deformation axis between zero and ۱.۵, ۳ and ۴.۵ mm deformations were obtained at five replications to assess the stored strain energy in the fruit. Results revealed that any increase in applied external displacement increased the bruised area. A high correlation ( $r=0.994$ ) was observed between bruised area and amount of stored strain energy. Other results indicated that the bruised area highly depended on skin elasticity. Increasing in skin modulus of elasticity decreased the bruised surface.

## کلمات کلیدی:

Keywords: Apple bruising, finite element, Fruit storing

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