Measurements of mechanical properties of hydrated and cooked lentils

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The transformation of lentils by hydrothermal treatments, leads to a great diversity of texture of the seeds. There is a need to develop a common rheological method to assess the texture of cooked lentils in order to improve and select varieties best suited to cooking. Texture changes obey different mechanisms, i.e. the evolution of the water content in the seed, starch gelatinising (or melting), proteins aggregating, the complexity of which is increased by the heterogeneity of the seeds. In this context, the aim of this work is to develop a method to measure the mechanical properties of hydrated and cooked lentils.
In this purpose, systems comprising mobiles of different diameters (0.6, 3, 10 mm) are applied in compression to different quantities of lentils (1 single, vs 17 g in a cell Æ 40mm). The selection of the measurement method is based on tests of repeatability, expressed by the error inherent in each method, and on their ability to distinguish between different cooking conditions and batches. For example, on the system (Æ 10mm), the apparent modulus of a cooked lentil decreases from 10 MPa after 8 minutes of cooking (T=95°C), to 1MPa when it is cooked for 25 minutes, with a relative error of 10%. The cooking kinetics at different temperatures are determined and adjusted by a simple mathematical model (Peleg, 1988), in order to determine the influence of the water content on the texture of the lentils. Starch transition temperatures and % gelatinized starch are determined by Differential scanning calorimetry (DSC). In complement, a device similar to Mattson cooker, equipped with 24 metal rods of 80g, each rod deposited on a lentil, is developed to determine the distribution of cooking time, and assess the heterogeneity of the lentil batches.