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# Kinetics of food bolus formation and nutrient bioaccessibility as a function of the progress of mastication of Frankfurters models

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The preparation of a food bolus for swallowing is the main task of oral elements involved in the masticatory process. The combined events designed for that are perfectly adjusted to food structure. With a correct oral state and normal mastication, a follow-up to the bolus formation provides great information regarding mechanisms underlying food breakdown and other processing during which oral sensations and first steps of digestion take place. The food bolus is the result of matrix breakdown and saliva incorporation that favors particles agglomeration, combined outcome finally triggering swallowing. This work aimed at investigating the kinetics of bolus formation along the masticatory process regarding physical characteristics and oral bioaccessibility of nutrients.

*In vitro* masticatory sequences were realized with the AM2 masticator apparatus programmed for normal mastication of Frankfurters thanks to *in vivo* data obtained during chewing the same food model. Normal masticatory sequences were experimentally stopped at different stages until the swallowing point (after 1/3, after 2/3 and at the end of the complete masticatory sequence). Frankfurters samples were prepared in cylindrical shape ( $6.5 \pm 0.2$  g). After liquid-solid phase separation, boluses were analyzed for physical (granulometry, rheological behavior) and chemical (protein/lipid oxidation, iron/peptides release in liquid phase) characteristics.

From the beginning to the end of mastication, median particle size decreased from  $9.38 \pm 2.64$  mm after 1/3 of the masticatory sequence to  $5.02 \pm 0.51$  mm in the swallowable bolus. At the same time, the Frankfurter food bolus became softer, stickier, and less cohesive and elastic. The release of free-iron and peptides in the liquid phase significantly increased (63% and 16% respectively) from the first third of masticatory sequence to the masticatory endpoint due to progressive matrix disintegration. Protein oxidation also significantly increased in liquid phase of the bolus of Frankfurter model.

This work highlighted significant changes in physical and chemical characteristics of food bolus throughout the masticatory sequence conferring emphasis on food matrix disruption and potential consequences to be considered both in terms of physical passage during swallowing and bioaccessibility of nutrients for example in case of impairment of this oral stage.