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Selection in mixtures of food particles during oral processing in man (Article)

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Abstract

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Objectives Two processes underlie food comminution during chewing: (1) selection, i.e. every particle has a chance of being placed between the teeth and being subjected to (2) breakage. Selection decreases with particle number by saturation of breakage sites, and it depends on competition between smaller and larger particles for breakage sites. Theoretical models were tested which describe competition between various sizes X. In the one-way model, small particles cannot compete with larger ones because of their smaller height. In the two-way model, small particles may compete when piled between antagonistic teeth. Design Five subjects participated in one-chew experiments on cubes made of Optosil®. The critical particle number ($n_c(X)$) at which saturation starts, and the number of breakage sites ($n_b(X)$) were determined by varying particle numbers (n_X) for single-sized cubes of 1.7-6.8 mm. Using $n_c(X)$ and $n_b(X)$, the models predicted relationships between number of selected particles ($n_s(X)$) and n_X in one-chew experiments using simple mixtures with only two sizes. A fixed number (mean 6 or 26) of larger cubes (X = 6.8 or 3.4 mm) was mixed with various numbers (16–1024) of smaller cubes (X = 4.8, 2.4 or 1.7 mm), thus varying the factors X, n_X, and possible particle piling (for X <4 mm). Results The one-way model was largely followed with small numbers of smaller particles and the two-way model with large numbers. Conclusions The two-way model applies to chewing a food which yields a loose aggregation of different-sized particles following an initial phase, whereas other circumstances may be favourable for the one-way model. As conditions of a food bolus can be approached by embedding hard Optosil particles in a soft medium, the models will, apart from dentistry, be of interest for controlling flavour release in food engineering. © 2017 Elsevier Ltd

Author keywords

Food comminution, Mastication, Mixture, Modelling, Selection

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