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Inclusion of the initial phase of mastication for determining chewing efficiency using a solid test food

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Chewing ability has been examined using the solid artificial test food Optosil®. The median particle size, X50, is determined after N chewing cycles, by curve-fitting of the particle size distribution using the Rosin-Rammler equation. Reduction of X50 with N is traditionally studied from N ≥ 15-20 cycles, because of initially unreliable values of X50. The first aim of the study was to show that the initial chewing phase can be considered by using initial particles of appropriate size, shape and amount. The initial phase is important because (1) greatest reduction in X50 occurs here, and (2) it includes a transition from a slower to faster reduction rate. The second aim was to compare measures of chewing ability, i.e. chewing efficiency (N needed to halve the initial particle size, N(1/2-Xo)) and chewing performance (X50 at a particular N-value, X50,N).

Eight young adults chewed 4 types of samples of particles: (1) 8 cubes of 8 mm, border size relative to bin size (traditional test), (2) 9 half-cubes of 9.6 mm, mid-size; similar sample volume, (3) 4 half-cubes of 9.6 mm, and 2 half-cubes of 9.6 mm; reduced particle number and sample volume. All samples were tested with 4 N-values. Curve-fitting with a 2nd order polynomial function yielded log(X50)-log(N) relationships, after which N(1/2-Xo) and X50,N were obtained.

Reliable X50-values are obtained for all N-values when using half-cubes with a mid-size relative to bin sizes. By using samples of 2 half-cubes, determination of N(1/2-Xo) or X50,N needs fewer chewing cycles and 40% less bite force than traditional tests, making a chewing test feasible for subjects with an impaired chewing ability. Chewing efficiency is preferable over chewing performance because of a comparison of inter-subject chewing ability at the same stage of food comminution, and constant intra-subject ratios between samples and constant inter-subject ratios within samples.