Oral processing of heterogeneous foods

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Abstract

Food manufacturers could potentially benefit from foods designed to influence mastication and the breakdown of food into a bolus. Mastication and the properties of the food bolus have been linked to the sensory and nutritional properties of foods. This research aimed to investigate the mastication and particle size distribution of the food bolus of heterogeneous food systems, where one food component is combined with another, with a view to indentifying parameters that influence mastication and the food bolus. A range of matrices of contrasting physical properties, which were embedded with peanut pieces of contrasting physical properties, were investigated.

Trials involved serving these heterogeneous foods to subjects standardized by volume (concluded as the most suitable serving method following an investigation of natural bite size). Subjects were asked to chew and expectorate the bolus (where the number of chews and chewing time were recorded) before the matrix of the expectorated bolus was washed away to isolate the peanut particles, and the peanut particle size distributions determined using image analysis. A Rosin-Rammler function was fitted to the cumulative distribution data of each bolus to derive peanut particle size parameters (d_{50} and broadness (b)).

Results demonstrated that in heterogeneous food systems the presence of one food component (the matrices) can alter the breakdown of another food component (the peanuts) embedded inside that matrix. The properties of the matrix influenced mastication, the rate of peanut particle size reduction, and the spread of the distribution of peanut particle size inside the matrix, but did not influence the d_{50} of the peanut particle size distribution inside the bolus. Peanut properties did not influence mastication, but influenced the d_{50} of the peanut particle size distribution, the rate of particle size reduction, and the retention of peanuts in the bolus. It is postulated that the properties of the matrices largely influence the probability teeth contact peanut particles (known as the selection function), and the properties of the peanuts largely influence particle fracture per chew (known as the breakage function).

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I feel obliged in this section of my thesis to finish up with a profound and philosophical statement. The best I could come with is a quotation by social commentator Karl Pilkington, who once said “Any problem solved is a new problem made”. This thesis is typical of any piece of science where the quest for greater knowledge and understanding will always continue.

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Experiments conducted in Chapter 4 were registered as low risk with the Massey University ethics committee. Experiments conducted in Chapter 6 (Southern A Application 08/17) and Chapters 7-10 (Southern A (Application 09/24) were approved by the Massey University ethics committee.

List of publications and presentations

Publications in international journals

Hutchings, S.C., Bronlund, J.E., Lentle, R.G., Foster, K.D., Jones, J.R., & Morgenstern, M.P. (2009). Variation of bite size with different types of food bars and implications for serving methods in mastication studies. *Food Quality and Preference*, 20, 456-460 (Appendix G).

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., & Morgenstern, M.P. (2011). Mastication of heterogeneous foods: Peanuts inside two different food matrices. *Food Quality and Preference, In Press, Corrected Proof* (Appendix H).

Conference presentations (oral and poster presentations)

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., & Morgenstern, M.P. (2010). 'The importance of chewing in food technology'. Oral presentation, NZIFST annual conference, Auckland, New Zealand.

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., & Morgenstern, M.P. (2010). 'Selection of subjects for mastication studies'**.** Poster presentation, Food oral processing, international conference, Leeds, UK.

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., & Morgenstern, M.P. (2010). **'**Mastication of heterogeneous foods: peanuts inside food matrices'. Poster presentation, Food oral processing, international conference, Leeds, UK.

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., Sun, C., & Morgenstern, M.P. (2009). 'Mastication of peanuts embedded inside different food matrices'. Oral presentation, NZIFST annual conference, Christchurch, New Zealand.

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., Sun, C., & Morgenstern, M.P. (2009). 'Mastication of peanuts embedded inside food matrices: A pilot study'. Poster presentation, Delivery of functionality in complex food systems, international conference, Wageningen, the Netherlands.

Hutchings, S.C., Foster, K.D., Bronlund, J.E., Lentle, R.G., Jones, J.R., & Morgenstern, M.P. (2008). 'Variation of bite size with different types of food bars and implications for serving methods in mastication studies'. Oral presentation, Biomouth symposium 2008, Rotorua, New Zealand.

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