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Mechanical insights into the textural perceptions of model beverages – a multivariate approach

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Mechanical insights into the textural perceptions of model beverages – a multivariate approach Piyali Chakraborty1, Dr Heather Smyth2, Dr Torsten Witt3, Dr John Ashton4, Dr David Harris4 and Prof Jason Stokes¬1 1 School of Chemical Engineering, University of Queensland, St Lucia 2 Queensland Alliance for Agriculture and Food Innovation, University of Queensland, St Lucia, QLD 4072, Australia 3 School of Agricultural and Food Sciences, University of Queensland, Brisbane, Australia 4 Sanitarium Development and Innovation, Cooranbong, NSW, Australia

ABSTRACT Interpreting the textural perceptions of food systems through in vitro measurements can generate meaningful insights into the underlying physical mechanisms of these perceptions, which can help in rational product design. However, capturing the "in-mouth physics" through in vitro measurements is still a challenge. The challenge may lie due to the multimodality of texture perception. Our hypothesis is that these multidimensional textural perceptions can be explained using a multivariate statistical approach, relating the complex textural perceptions to the fluids' physical properties.

The sensory properties of model hydrocolloid beverages were modified with the addition of two commercial oat bran fibres that contain varying soluble and insoluble dietary fibre. The beverage matrices were characterised both sensorially and physically using sensory descriptive analysis, bulk rheology and soft tribology measurements. The relationships between the physical properties of the samples and their textural attributes were examined using statistical data analysis techniques (PCA, PLSR). The results show that while thickness is explained through correlation with any viscosity value (within the measured shear stress range), similar correlations (with a single viscosity/friction value) do not exist for complex mouthfeel perceptions, for example – sliminess and particle perception. Instead, these attributes relate with multiple physical parameters of the system — these relationships formulated by Partial Least Square Regression (PLSR) models. The models demonstrate that particle-related perceptions are related to the boundary regime friction and degree of shear thinning of the fluid, while, sliminess-related perceptions are linked to the slope and onset of the mixed lubrication regime and the fluid high shear viscosity. This research decouples the multiple physical attributes potentially relevant for a textural perception, suggesting that multivariate data analysis can be employed to choose the relevant physical parameters for any textural perception. This concept can also be extended to understand the physical origins of the textural perceptions of solid food systems.