

Rheological Properties of Protein Improved Plant-Based Purees for Oro-pharyngeal Dysphagia Consumption

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"One cannot think well, love well, sleep well, if one has not dined well." - Virginia Woolf, A Room of One's Own

Introduction

- Inability of the food bolus passage from mouth to esophagus is defined as oropharyngeal dysphagia (OD). OD patients are at risk to experience aspiration pneumonia, malnutrition and dehydration. Therefore, the objective of this investigation was to determine the rheological properties of protein improved plant-based puree for OD consumption [1].

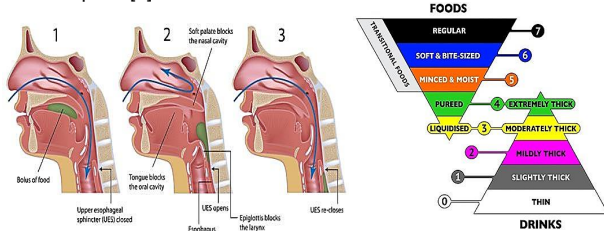


Fig. 1 International Dysphagia Diet Standardization Initiative framework [2].

Materials and Methods

Materials

- Raw materials: sea buckthorn pulp and strawberry pulp juice, apple, pumpkin and Jerusalem artichoke puree.
- Protein sources: soy (S), whey (W), pea (P).
- Protein concentrations: 5% (5), 9% (9).
- Heat treatments: pasteurization (P), sterilization (S).

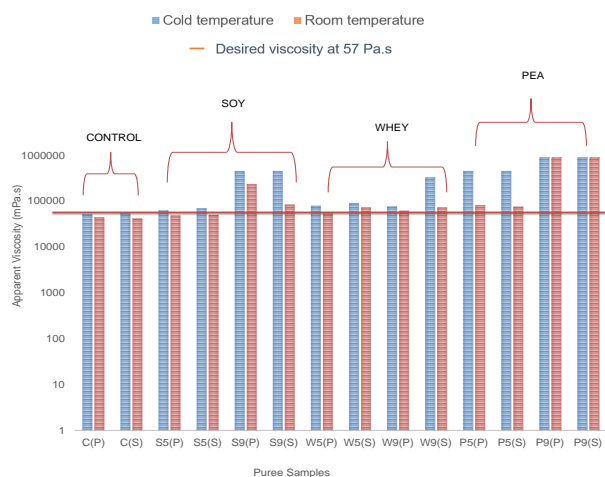
Methods

- Samples to be analyzed were prepared by vacuum cooking ($79 \pm 2^\circ\text{C}$, 0.06 MPa, 15 min). Individual samples were subjected to secondary heat treatments, pasteurization ($95 \pm 2^\circ\text{C}$, 15 min) and sterilization (115°C , 5 min).
- Viscosity was determined by DV – III Ultra Rheometer, using TF spindle, consistency by Texture Analyzer TA.HD Plus using a back extrusion rig, while shear stress and viscoelasticity by MCR 302, using a cone-plate geometry system, and flow ramp was performed at 25°C at shear rate 0 to 300 s^{-1} , cone-plate geometry determining sweeps with strain at 0.01% - 100% at 1 Hz of frequency at 25°C , thus storage modulus (G') and loss modulus (G'') described the products rheological characteristics respectively.

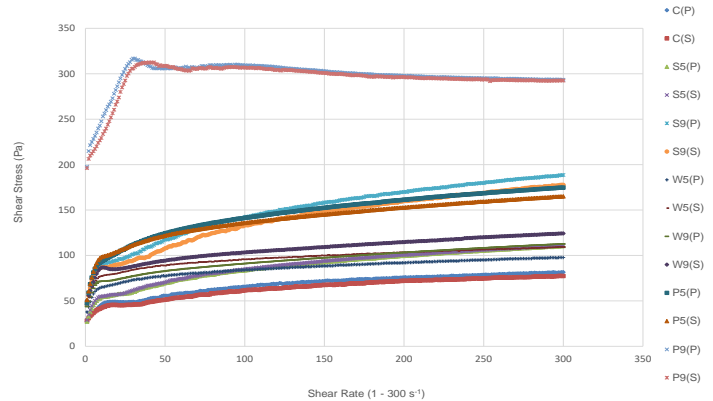


Results & Discussions

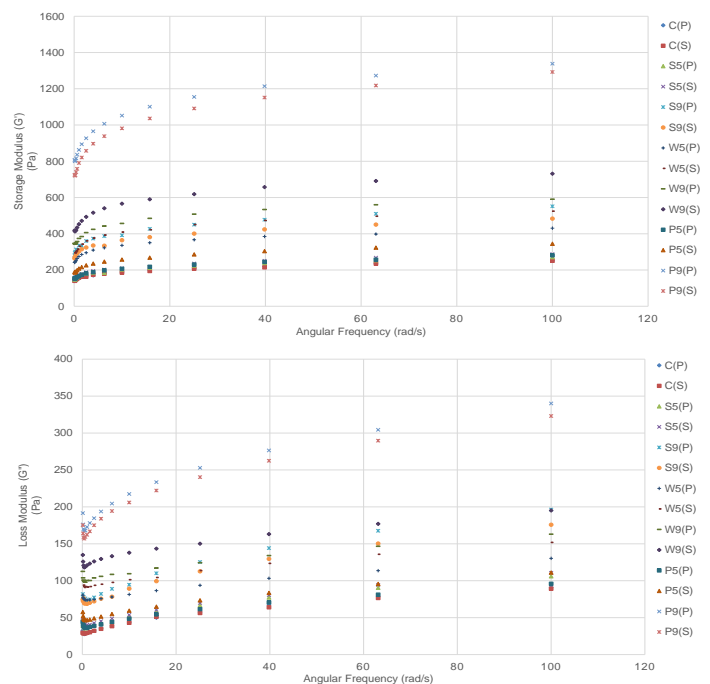
Apparent Viscosity



Shear Stress



Viscoelasticity



Conclusions

- Significant impact on the rheological properties of plant – based puree for dysphagia patients was observed upon fortification with protein – soy, whey, and pea. Protein additive increased viscosity of puree. Pea protein proved to be unfit for the purpose of this investigation.
- Continuous increase of G' and G'' indicated the inability of the samples to form a gel. Such textural behaviour is a crucial quality feature of product for oro-pharyngeal dysphagia patients.
- All samples indicated shear – thickening characteristic, which may be due to particle size and friction between these particles. However, it is highly debatable whether it was caused by the protein source or overall proteins and their interaction with other compounds present in the samples. Further investigations should be done to verify the actual cause for such behaviour.

Acknowledgement

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References

- [1] Espitalier, F., Fanous, A., Aviv, J., Bassiouny, S., Desuter, G., Nerurkar, N., ... Crevier-Buchman, L. (2018). International consensus (ICON) on assessment of oropharyngeal dysphagia. *European Annals of Otorhinolaryngology, Head and Neck Diseases*, 135(1), S17–S21. <https://doi.org/10.1016/j.annorl.2017.12.009>
- [2] Steele, C. M., Namasivayam-MacDonald, A. M., Guida, B. T., Cichero, J. A., Duivesteyn, J., Hanson, B., ... Riquelme, L. F. (2018). Creation and Initial Validation of the International Dysphagia Diet Standardisation Initiative Functional Diet Scale. *Archives of Physical Medicine and Rehabilitation*, 99(5), 934–944. <https://doi.org/10.1016/j.apmr.2018.01.012>