

The main objective of this work was to determine whether the IDDSI thickness levels are sufficiently differentiated to be treated as valid therapeutic thickness levels for the treatment of dysphagia of differing severity as assessed using a validated water protocol, by establishing a correlation between IDDSI thickness levels and dysphagia grades of Water Drinking Test.

and have been focusing on the study of the classification of liquids and semi-solids which frequently lead to aspiration and cough for dysphagia. The work was conducted in collaboration with Prof. Jianqin Sun and her group at Huadong Hospital in Shanghai. Ourdiet Swallow (Ourdiet, Guangzhou, China), a commercial thickener product, was used for the test. Four liquid samples of different concentrations (0.54, 1.16, 2.36, and 4.20 %) were found at the boundaries of each of levels 0, 1, 2, and 3 according to Flow Test provided by IDDSI. The shear viscosity was measured using a DHR-2 rheometer (TA Instruments, New Castle, USA) with a cone-and-plate geometry (diameter = 40 mm, angle = 2.008°). Apparent shear viscosity of sample 0.54, 1.16, 2.36, and 4.20% at 50 s<sup>-1</sup> were determined to be 37.2, 84.1, 206.4, and 434.6 mPa·s, respectively. Altogether 26 elderly subjects were recruited and assessed for their dysphagia grades using the Water Drinking Test. Subjects were provided with a series of samples based on a modified Volume-Viscosity Swallow Test (V-VST) test and the swallowing performance (time of swallowing, number of swallows, and number of coughs) was recorded and analyzed (Fig.1).

Strong correlations among swallowing capability parameters were observed. More importantly, results from this work clearly demonstrated that severity of dysphagia with water-based swallows correlates positively with IDDSI thickness levels aimed at reducing dysphagia symptoms in those patients (Fig.2), confirming the reliability and feasibility of IDDSI framework for clinical applications. This work is accepted for publication in

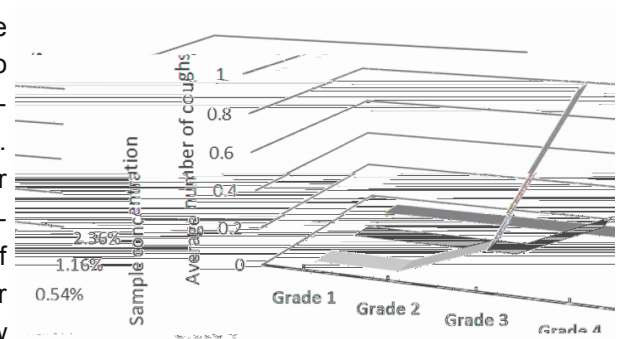


Figure 1: Coughing number when swallowing 20ml samples for patients at different grades as assessed by the Water Drinking Test.

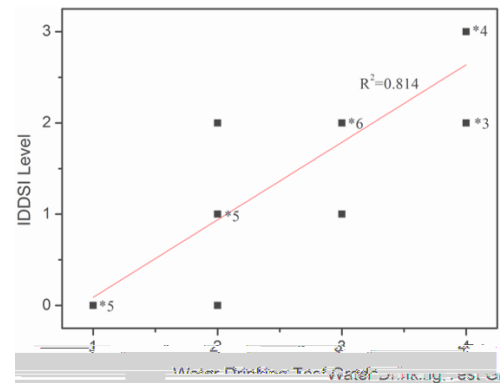


Figure. 2 A plot of the IDDSI texture level against the swallowing capability as assessed by the Water Drinking Test. The number next to asterisked points represents the numbers of subjects at that same point.

Dr. Rammile Ettelaie from University of Leeds, UK, paid a visit to the group in December 2016 and gave a seminar.

Dr. Peter Xu, School of Mechanics of Auckland University (New Zealand), paid a visit to the group on March 17<sup>th</sup> and gave a seminar presentation. Peter is a world-leading expert on soft robot and currently working on the design of a swallowing instrument.

Dr. Hilbert van der Glas of University of Dundee, UK, (retired from Utrecht University, The Netherlands) conducted a visiting research to the group between April 6<sup>th</sup> and May 4<sup>th</sup>. Hilbert is an appointed International expert of the University.

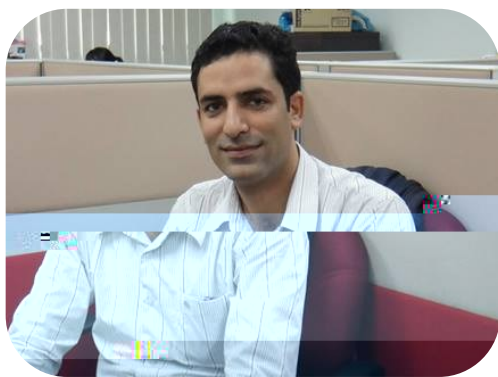
Dr. Sangeeta Prakash of Queensland University (Australia) paid a short visit to the group on the April 17<sup>th</sup> and 18<sup>th</sup>. Sangeeta has established great research experience on sensory analysis and oral tribology studies.

Dr. Christos Ritzoulis is currently with the group as an adjunct professor. Christos is an expert on food colloids and physical



, the Governor of Zhejiang Province visited the School on March 21<sup>st</sup>, 2017. He was introduced by the dean of the School, Prof. Jianzhong Han, and visited the School's exhibition room and also the Food Oral Processing laboratory. The governor praised highly to School's recent developments and achievements both in scientific researches and student training. He expressed his satisfaction of the smooth transition of Prof. Jianshe Chen from Leeds to Zhejiang Gongshang University and the successful establishment of the joint research laboratory of food oral processing, which is world leading and the only one in the country.

who comes from Malaysia, joined the Food Oral Processing Research Group in the end of December, 2016. He completed his bachelor degree in Food Science and Nutrition (with honors) in UCSI University, Malaysia, and PhD in Food Engineering in University Putra Malaysia. He worked as a part time lecturer in Taylor's University in Malaysia after graduation then got a full time job at Dimension International College in Singapore. Now he is cooperating with Firmenich Aromatics (China) Co. Ltd to work on the freshness and mouthfeel of tea. He is glad to join the group as a post-doctoral fellow.



comes from Kashmir, India, where he got his BSc in Bioscience from University of Kashmir. He received his MSc in Biochemistry specializing in enzymology. He pursued his PhD in Food Science (PSU, Thailand) and worked as a postdoctoral researcher in Bioactive food Packaging (USM, Malaysia). Subsequently, he served as lecturer in Mahidol University for 2.5 years where he taught food chemistry. He joined the FOP lab as a postdoctoral researcher where he will study the rheology and interactions of different biopolymers with the saliva and its link to the sensory properties.



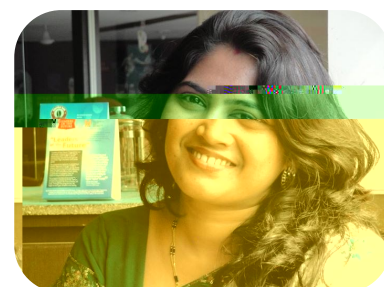
recently joined Food Oral Processing research group as a Postdoctoral Fellow. He got his Bachelor and PhD in Chemical Engineering from The University of Queensland. His PhD project was focused on the rheology of thickened fluids for dysphagia sufferers. His project at Zhejiang Gongshang University now is focused on the texture modification and characterization of food for elderly consumption. He is currently working on the rheological characterization of thickened fluids in extensional deformation.

got his bachelor's degree in Biotechnology from Bharathidasan University and MSc in Food Technology from Anna University. He did his PhD in Engineering Sciences (Food Science and Engineering) from CSIR-Central Food Technological Research Institute (India). He worked as a research associate at IIFPT, India after PhD.



He is a recipient of Best Research Award of 2014/2015 at CSIR-CFTRI. He will be working on a collaborative project between ZJGSU and University of Leeds as a postdoctoral fellow on manipulating oral behaviour of food emulsions by using different food emulsifiers.

Oil-in-water emulsions can be differentiated for smoothness perception based on the oil mass fractions and emulsifier types. There exists a correlation between people's responses and physical measurements. Humans are able to detect differences that are significantly different using oral tactile and finger tactile measurement techniques. Also, oral tactile measurements were highly significant compared to finger tactile, a study by Dr. Rutuja Upadhyay that shall soon be published.



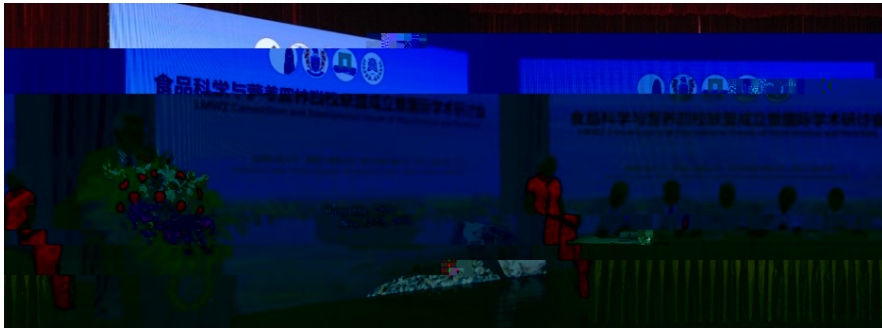
A project on the design and characterization of swallowing product for swallowing difficulty and dysphagia patients has been completed. The project was sponsored by Qirui Pharmaceutical company of Jiangsu province.

participated in the public benefit activity themed as "Popularize healthy dietary knowledge for the elderly", at Suiyuan Jiashu Nursing Home in Yuhang District of Hangzhou on December 7<sup>th</sup>, 2016, accompanied by Dr. Rammile Ettelaie from the University of Leeds in UK and two master students.

The main purpose of this activity is to impart safe diet knowledge and guide elderly safe diet to reduce the risks of coughing or choking. This public benefit activity includes three parts: the report of "popularizing elderly healthy eating knowledge", the field assessment of dietary capacity for elderly and diet investigation for elderly.

As a member of International Dysphagia Dietary Standardization Committee, and the deputy head of China mainland and Hong Kong, Macao and Taiwan expert group, Prof. Chen's excellent speech won the unanimous praise of the elderly and medical staff. The gracious interaction between Prof. Chen and the elderly created a harmonious and friendly atmosphere throughout the whole activity. The field assessment for the elderly about eating capability also received positive responses. Prof. Chen called for attention and continuous effort of the society on the elderly's living quality at the end of the activity.

The FOP group has been working on a joint project on chili perception with and in the University of Nottingham. In their study, the amount of saliva



## LWMZ University Consortium of Food Science and Nutrition

Our master student, [REDACTED] has been successful in winning a scholarship from the China Scholarship Council for the doctoral studies at Wageningen University and Research Centre (WUR), the Netherlands.

[REDACTED] has been selected as an exchange student to the Kagawa University in Japan. She says "It is a good chance for me to expand my horizons. I am looking forward to learning new culture and I am sure I will definitely benefit from this experience".

[REDACTED], a second year master student, working on rheological properties of natural mucilage, will be visiting The School of Food and Nutrition, Massey University's Manawatu Campus in Palmerston North this summer.

- [REDACTED] by the University Consortium of Food Science and Nutrition. November 17-18<sup>th</sup>, 2017, Hangzhou, China.
- [REDACTED], "Application of Soft Matter Concepts," University of Leeds, April 8-11<sup>th</sup>, 2018, Leeds, UK.
- [REDACTED], University of Nottingham, July 1-4<sup>th</sup>, 2018, Nottingham, UK.

Two papers from the group have been assigned as ESI highly cited papers in 2016:

- The eating capability: Constituents and assessment, *Food Quality and Preference*, 48, 345-358.
- The influence of food texture and liquid consistency modification on swallowing physiology and function: a systematic review, *Dysphagia*, 30, 2-26.

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- Zheng, G., Su, M., Lv, Z. & Chen, J.\* (2017). Biting force and tongue muscle strength as an indicator for the eating and swallowing capability of elderly patients. *Dysphagia*, submitted for publication.
- Su, M., Zheng, G., Sun, J., Lv, Z. & Chen, J. (2017). Clinical application of IDDSI framework. *Journal of Texture Studies*, under revision.
- Wang, X.\* & Chen, J. (2017). Food oral processing: recent developments and challenges. *Current Opinion in Colloid and Interface Sciences*, 28, 22-30.
- Mosca, C.\* & Chen, J. (2017). Food-saliva interactions: mechanisms and implications. *Trends in Food Science and Technology*. Accepted for publication.
- Sanahuja, S., Upadhyay, R., Briesen, H. & Chen, J.\* (2017). Spectral analysis of the stick-slip phenomenon in "oral" tribological texture evaluation. *Journal of Texture Studies*, 1, 1-17. DOI: 10.1111/jtxs.12266.
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- Laguna, L., Aktar, T., Ettelaie, R., Holmes, M. & Chen, J.\* (2017). Physiological impact of ageing on eating capabilities. *Journal of Texture Studies*, accepted for publication.
- Laguna, L., Barrowclough, R.A., Chen, J., Sarkar, A.\* (2016). New approach to food difficulty perception: Food structure, food oral processing and individual's physical strength. *Journal of Texture Studies*, 47, 413-422. DOI: 10.1111/jtxs.12190.
- Cichero, J.A.Y.\*, Lam, P., Steele, C.M., Hanson, B., Chen, J., Dantas, R.O., Duivestein, J., Kayashita, J., Lecko, C., Murray, J., Pillay, M., Riquelme, L. & Stanschus, S. (2016). Development of international terminology and definitions for texture-modified foods and thickened fluids used in dysphagia management: the IDDSI framework. *Dysphagia*, DOI 10.1007/s00455-016-9758-y.
- Mosca, C.\* & Chen, J. (2017). Objective and subjective aspects of food oral texture assessment. *Elsevier Reference Module (Ed. L. Day)*, Elsevier.
- Aktar, T., Upadhyay, R.\* & Chen, J. (2017). Oral sensation and perception of creaminess. In *Oral Mechanisms of Mouthfeel*. G. Carpenter (Ed.),
- Laguna, L., Sarkar, A. & Chen, J. (2017). Eating capability assessment in elderly population. In *Nutrition and Functional Foods for Healthy Aging*. R. Watson (Eds), Elsevier.