



Oral surface temperature: noninvasive measurements and implication to texture sensation

FOP GROUP LOGO



食品口腔加工實驗室
Lab of Food Oral Processing

LAB OPEN DAY

The FOP Lab will have its first Open Day on **Saturday (the 6th of January 2018)**. Everyone is welcome. If interested, please contact us to reserve a place.

• A range of maltodextrin solutions (viscosity range from 50 to 100 mPa·s) were prepared to explore the effects of capsaicin and tongue surface temperature on textural discrimination. A total of 20 healthy subjects (10 females and 10 males) participated in this study. It was found that the capsaicin solution had no significant impact on the tactile sensitivity of the tongue ($P > 0.05$). However, tongue surface temperature significantly affected vibratory perception threshold ($P < 0.05$), though it had little effect on touching and two-point discrimination thresholds. Most interestingly, positive correlations were observed between shear viscosity discrimination and vibratory perception (Figure 2), even though there was no direct correlation between shear viscosity discrimination and touching sensitivity, and two-point discrimination thresholds. The above finding implies that vibratory sensations could play a critical role in viscosity sensation and perception.

The main objective of this work was to establish a novel, non-contacting and noninvasive method for measuring tongue surface temperature and to access the impacts of oral temperature on the lingual tactile sensations and the capability of texture discrimination.

Mr. Cong Lv, a master student, has been working on this project and he is very pleased to present that:

• A novel experimental method has been established to measure tongue surface temperature by using an infrared thermal (IRT) imager (calibrated with a digital thermometer). This novel method would not only make temperature visible, but is also quick and accurate. As shown in infrared thermal images (Figure.1), physical treatment (rinsing mouth with 0, 20, 37, and 45°C water) would alter tongue surface temperature to 20.6, 26.7, 33.6 and 37.7°C, respectively. Additionally, chemical factor (treated with 5, 10, 20 ppm capsaicin solutions on tongue surface) was found to increase tongue surface temperature. Especially at the tip of tongue, a 1.34 °C increase of tongue surface temperature was observed after the tongue was treated with 20 ppm capsaicin solution for 60 sec. The method has also been used to monitor temperature change of food during oral processing.

• Thresholds of light touch, vibration perception, and two-point discrimination on tongue surface were determined as influenced by capsaicin treatment and temperature increase. Semmes-Weinstein monofilament, Bio-Thesimeter and Touch-Test® Two-point discriminator were applied for such purposes, respectively.

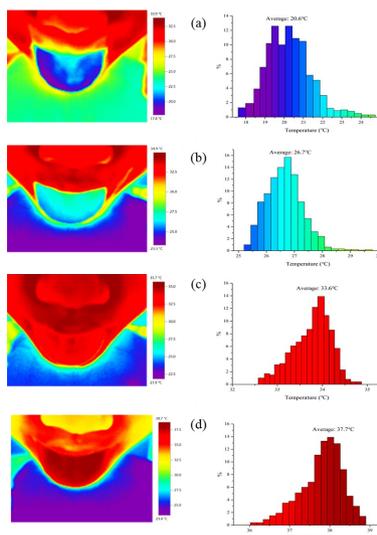


Figure 1. Images (160 × 120 pixels) of one representative subject and corresponding histogram of temperature distribution after his/her mouth rinsed with water of different temperatures: (a) cold water (0°C), (b) cool water (20°C), (c) warm water (37°C) and (d) hot water (45°C).

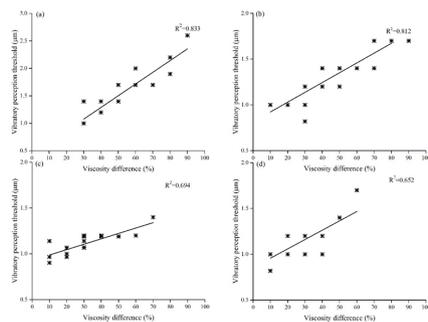


Figure 2. Correlation between capability of shear viscosity discrimination and the vibratory perception sensitivity: (a) rinsed with 0°C water; (b) rinsed with 20°C water; (c) rinsed with 37°C water; (d) rinsed with 45°C water

FOP GROUP NEW MEMBERS : WARM WELCOME

MASTER STUDENTS 2017



Mr. Wei Chen (Levi), graduated from Hunan Jishou University, is starting his master degree study at Zhejiang Gongshang University. His research project will focus on rheological studies of elderly food. He acts as the secretary of Party branch and is a member of Publicity Committee of the Graduate Student Union of ZJGSU.



Mr. Yifan Zhang (Ivan) completed his bachelor's degree at Zhejiang University of Science and Technology. His project investigates chewing efficiency of human individuals and influencing factors. He is also a member of Literature and Art Committee of Graduate Student Union of ZJGSU. He loves music and singing.

Mr. Xinqun Wang (Joy) completed his bachelor's degree at Zhejiang Gongshang University and will continue his research in FOP group as a master student. His research focuses on the studies of oral tribology. He loves physical activities, especially badminton and Ping-pong.



GOOD NEWS



Dr. Christos Ritzoulis, a member of the Food Oral Processing Group and Distinguished Scholar of the Zhejiang Gongshang University, was recently awarded a full Professorship in Food Chemistry at the Department of Food

Technology at ATEI Thessaloniki. Christos has made considerable contributions to the School of Food Science and Bioengineering. He wanted to thank all members of the Food Oral Processing Group and hoped for his contribution to expand with future fruitful projects as to produce the maximum scientific output.

PHD STUDENTS 2017



Ms. Urooj Chaudhry is from Pakistan. She has recently joined FOP group as a doctoral student. Previously, she completed her BSc and MSc in Biochemistry from University of Lahore and University of Veterinary and Animal Sciences, Lahore, Pakistan, respectively. Before landing in Hangzhou, Urooj worked as a visiting lecturer in Food and Nutrition department at Minhaj University, Lahore. She has got prestigious CSC fellowship from Chinese government to conduct her doctoral dissertation. Her research will focus on the behavior of oral mono-layer and its impacts on oral sensation. Through this research, she aims to explore novel spectacles of oral sensational milieu in humans.

Mr. Qiong Fu comes from Hunan province. He completed his bachelor's degree in Dalian Nationalities University and got his master degree from Central South University of Forestry and Technology. Also, he has worked as a research manager for 3 years at Zhang-jiajie Jinni Bioengineering Co., Ltd (831158). After that, he

held a lecturer position in Hunan Applied Technology University. And now he is undertaking his PhD in Food Science at Zhejiang Gongshang University and focusing on oral flocculation of food emulsions.



INVITED TALKS



• **Prof. Jianshe Chen**, November 10, 2017, Qianjiang Nutrition Forum, Hangzhou, "Critical role of food matrix in delivery and absorption of nutrients".

• **Prof. Jianshe Chen**, December 2, 2017, China Special Food Conference, Taizhou, "The eating ability and food texture design for elderly population".

• **Dr. Xinmiao Wang**, August 16, 2017, 1st Annual Expert Convening on Texture Science in Dairy Applications, "Fat-related sensory perception of dairy products: mechanisms and characterizations".



INTERNATIONAL VISTORS



Dr. Mark Malone, R&D director of Fonterra, New Zealand, recently visited FOP Lab. Mark has a extensive experience in the food and dairy sector. He joined Fonterra in 2005 after many years research work at university in the UK. During his visit, Mark kindly shared his views and experiences of food science research and consumer studies.

Dr. Ofir Benjamin is a lecturer and researcher at the Food Science Department in Tel Hai College. His research expertise deals with food sensory, food structure and research in dairy technology with sensory aspects. Ofir's latest work dealt with taste profile of salt reduced cheeses using advanced sensorial techniques.



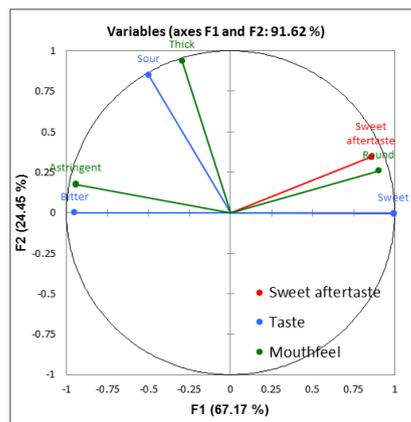
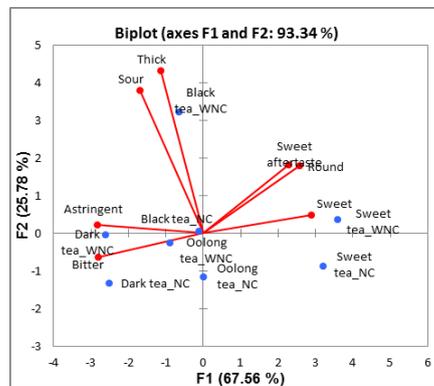
Dr. Markus Stieger is an Associate Professor for Food Technology and Sensory Science at Wageningen University, Division of Human Nutrition (The Netherlands). His current research focuses on food oral behavior and the transformation of food structures into sensory perception which contribute to the pleasure of eating and delivery of nutrients.



Dr. Alexandra Cury is an Associate Editor at Wiley. She has worked in the publishing industry for 5 years and began her career in scientific journal publishing at Elsevier. Thereafter, she joined Wiley's in-house editorial team where she managed titles from the Wiley Interdisciplinary Reviews (WIREs) and current journal protocols.

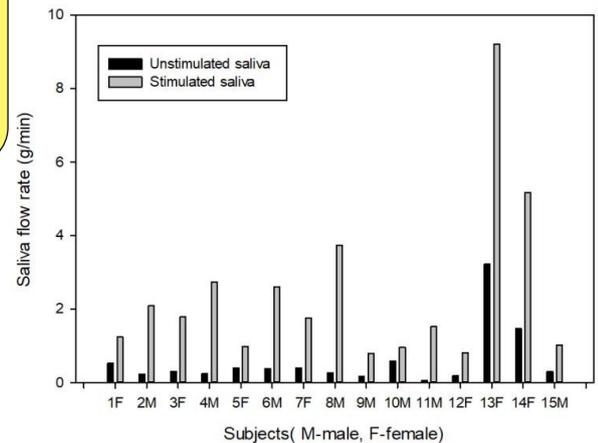


Dr. Pik Han Chong (Hanley) has been working on a project sponsored by Firmenich Aromatics (China) Co. Ltd, Shanghai. The general sensory attributes of tea were divided into: taste (e.g. bitterness, sweetness), aroma (e.g. fruity), and mouthfeel (e.g. astringency, roundness). The "sweet aftertaste" was one of the positive terms for a good quality of tea infusions. A good understanding of the mechanisms underpinning the sweet aftertaste perception is hugely important for tea beverage design. Panelists were recruited at Zhejiang Gongshang University and a 4-month training on sensory attributes of tea was provided. The correlation of sweet aftertaste of tea with other sensory attributes has been analyzed and shown on the right figures. Currently, Hanley works on the lubrication properties of human saliva before and after mixed with tea.

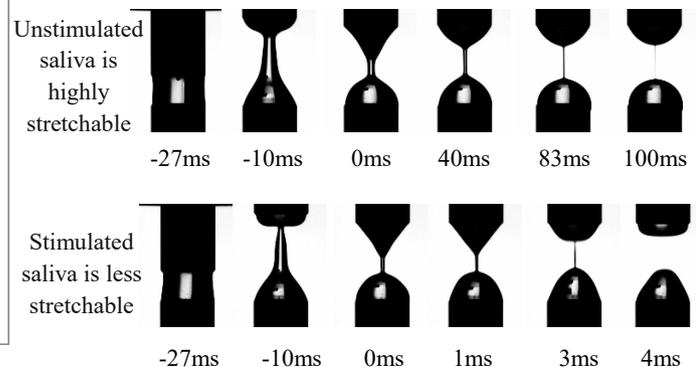


PCA on sweet-after-taste with other sensory attributes

Ms. Lanxi Qin has been working on saliva composition analysis. Based on the difference in saliva flow rate and several biochemical indexes between people of different ages, genders and dietary habits, she is hoping to find oral physiological interpretation of one's eating behavior. Lanxi noticed an interesting phenomenon that different persons could have totally different salivary profiles which changes by the time of the day. Apparently, if a person has worked for a long hours, the flow rate will decline drastically and the color will become yellowish.



Ms. Huan Liu is currently working on the rheological behavior of saliva among Chinese by measuring shear viscosity and extensional viscosity. She aims to investigate the effects of age on rheological behavior of saliva. With the help of **Dr. Enrico Hadde**, she can qualitatively assess the dynamic behavior of a saliva, with the help of a high speed camera. The data gives us a visual information about the extensional behavior of saliva. She hopes that this research would aid in a better understanding of the role of human saliva in eating and sensory perception.



Dynamic behavior of saliva using high speed camera



Dr. van der Glas and Ms. Ting Liu are working together in trying to determine the chewing efficiency using a solid test food. Chewing efficiency is an important physiological index of chewing ability, which is quantified by the number of chews ($N(1/2-X_0)$) needed to achieve an X_{50} value that equals to half of the initial particle size. In the experiment, 8 healthy volunteers were selected and each volunteer was provided with a specific particle shape, size and number of Optosil to chew. The chewed particles were sieved using a stack of 10 sieves of different apertures, the percentage of the underweight of each sieve was acquired and then fit into the Rosin-Rammler curve and calculated $N(1/2-X_0)$. They found that by using 2 or 4 half cubes, less chewing cycles was needed than traditionally for chewing efficiency determination. They also found that chewing efficiency is preferred over chewing performance.



The Inaugural Meeting of A Joint Project Sponsored by the Ministry of Science and Technology




国家重点研发计划项目
食品风味特征与品质评价及加工适用性研究
课题1 食品风味感知与喜好影响机制及中国风味地图构建
课题启动会 北京 2017.11.11

Food Industry Forum by the University Consortium of Food Science and Nutrition (17-18 November, 2017)



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Food Summit, Wuxi, China 2017 & 14th Annual Meeting of CIFST



PROJECT AWARDS

- Nestle: Texture characterization of thickening products for dysphagia patients.
- Pulmuone: Assessments of textural properties and consumers' preference of noodle products.
- The 13th Five-Year Plan grant from the Ministry of Science and Technology: Food oral processing and psychophysical mechanisms of flavor and preference.

CONFERENCE NEWS

- 17th Food Colloids Conference, "Application of Soft Matter Concepts," University of Leeds, 8-11th April, 2018, Leeds, UK.
- International Conference of Sensory Science, 27-28th April, 2018, Beijing, China.
- 5th Food Oral Processing Conference, University of Nottingham, 1-4th July, 2018, Nottingham, UK.

PRESTIGIOUS APPOINTMENT FOR PROF. CHEN



NEW PUBLICATIONS

- Pejcin, B., Tommonaro, G., Glumac, M., Jakimov, D., & Kojic, V. (2017). The redox couple avarol/avarone in the fight with malignant gliomas: the case study of U-251 MG cells. *Natural Product Research*. Accepted.
- Lv, C., Yang, N., Wang, X., & Chen, J. (2017). A non-invasive method for measuring tongue surface temperature during food oral processing. *Journal of Texture Studies*. Submitted.
- Liu T., Wang Xinmiao., Chen J., Hilbert W. van der Glas. (2017). Determining chewing efficiency using a solid test food and considering all phases of mastication. *Archives of Oral Biology*. Submitted .
- Hadde, E. K. and Chen, J. (2017). "Shear and Extensional Rheological Characterisation of Thickened Fluid for Dysphagia Management." *Journal of Food Engineering* . under review.
- Yuan B, Ritzoulis C, Chen J. (2018). Extensional and shear rheology of a food hydrocolloid. *Food Hydrocolloids*, 74: 296-306.