PCS Instruments

Leaders In Tribology Test Equipment

PCS Instruments

Design and manufacture world leading tribology test equipment

35 +	**Years**
3,000 +	**Instruments**
100 +	**Countries**
500 +	**Technical Papers**

PCS Instruments

35 + Years

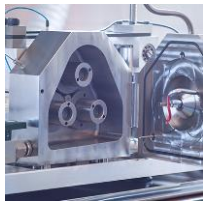
3,000 + Instruments

100 + Countries

500 + Technical Papers

MPR

MPR-GI



MTM

MTM-EC

ETM

HSD

Rolling Contact Fatigue + Surface Damage

Traction, Additive Activity & Surface Damage

EHD

EHD-HS

USV

ABS

HFRR

HPR

Lubricant Film Thickness

Viscosity

Fuel Lubricity

Friction & Wear

PCS Instruments

35 + Years

3,000 + **Instruments**

100 + Countries

500 + Technical Papers

8 + Industries

MTM

A ball-on-disc instrument for measuring the frictional properties of lubricated and unlubricated contacts under a wide range of rolling and sliding conditions.

HFRR

A ball-on-disc, high-frequency, reciprocating instrument for assessing the lubricity of both fuels and lubricants under boundary conditions.

Relevant Industries:

Food & Beverage

Biomedical

Lifestyle

PCS Instruments

MTM

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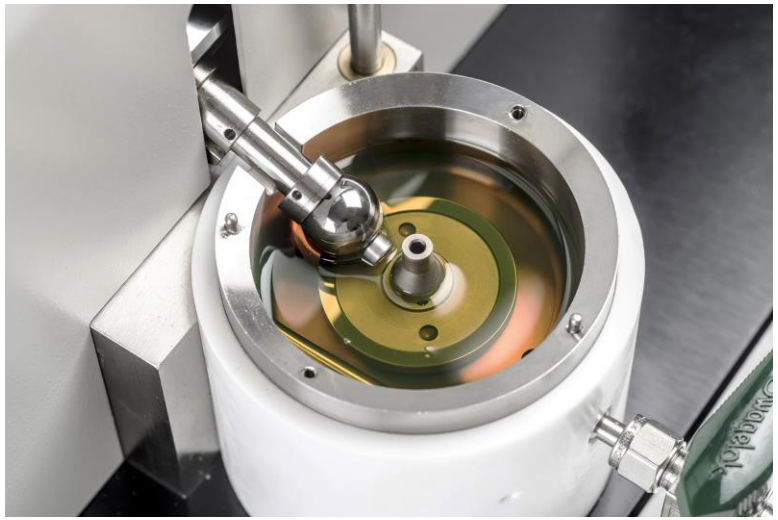

Relevant Industries:

- Food & Beverage
- Biomedical
- Lifestyle

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MTM - Instrument Overview

Repeatable and accurate
Excellent instrument-to-instrument reproducibility.

Featured in 500+ Publications
Proven instrument with over 300 systems sold worldwide.

User friendly
Easy training for new users

Reliable
Durable over many years of regular, daily operation

Continually improving
Ongoing R&D initiatives ensure that the MTM remains a market-leading product

Flexible
A wide range of specimen options makes the MTM a very versatile and popular options across many industries:

In-service Features:

- Fast to clean and easy to set-up for operators.
- Simple step-by-step calibration procedure with pre-defined limits to preventing calibration errors.
- Instrument operates on pre-defined ‘test profiles’, allowing the operator to simply select a profile to be executed.
- The MTM is fully automated, so can be left during testing.

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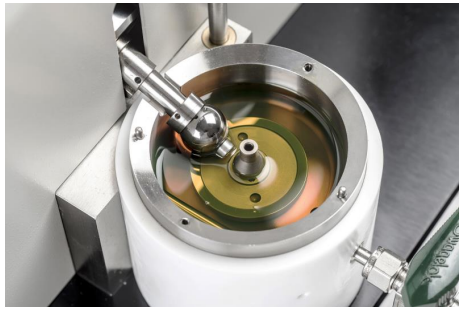
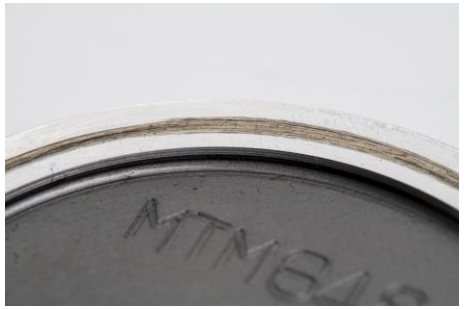
MTM – Technical Specifications

Load	10 to 75 N **2 to 8 N with optional low load beam**
Contact Pressures	0 to 1.25 GPa (standard specimens)
Speed	+/- 4 m/s
Slide / Roll Ratio	+/- 10,000 %
Temperature Range	Ambient to 150°C Below ambient possible with optional oil cooler
Test Sample Volume	35ml 10ml with optional pot filler
Dimensions (h x w x d)	400mm / 18” x 400mm / 18” x 600mm / 24”
Weight	30 kg / 66 lb





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MTM – Food Applications

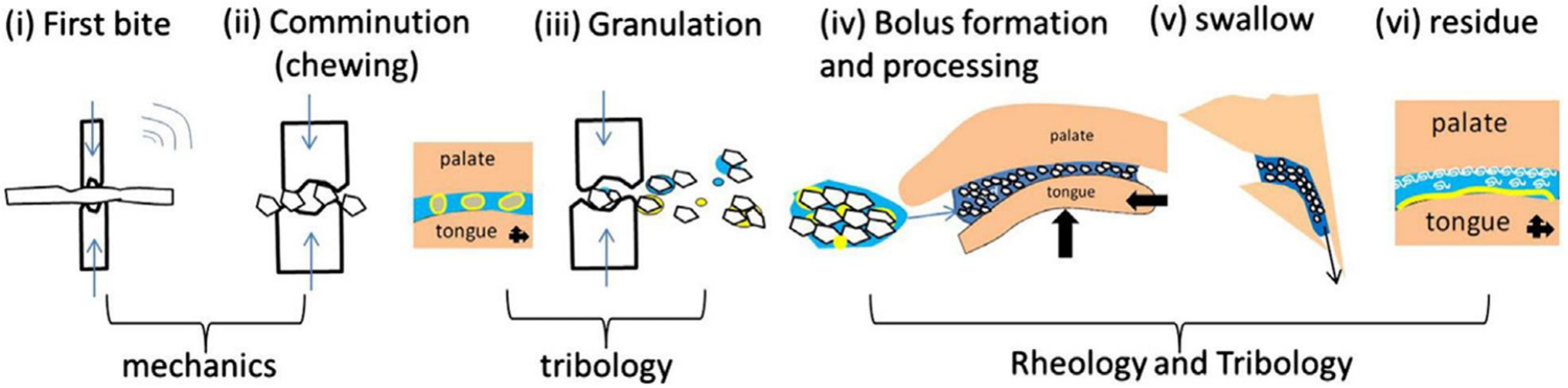
1. Oral Processing

Food oral processing includes all muscle activities, jaw movements, and tongue movements that contribute to preparing food for swallowing.

2. Sensory Perception

Sensory perception determines how you experience different flavours and textures in food.

MTM – Oral Processing



Jason R. Stokes, Michael W. Boehm, Stefan K. Baier,
Oral processing, texture and mouthfeel: From rheology to tribology and beyond,
Current Opinion in Colloid & Interface Science,
Volume 18, Issue 4, 2013, Pages 349-359, ISSN 1359-0294,
https://doi.org/10.1016/j.cocis.2013.04.010.

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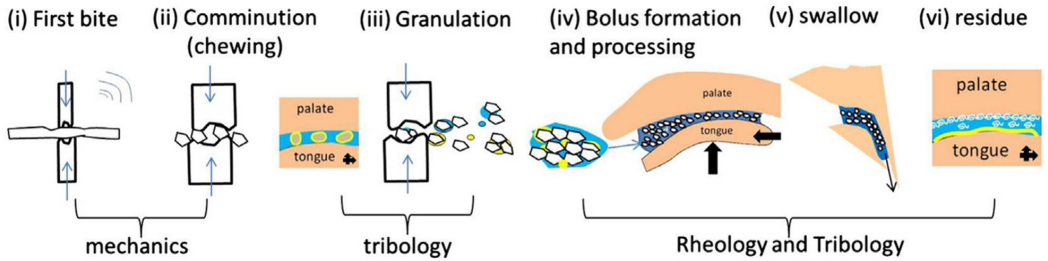
MTM – Oral Processing



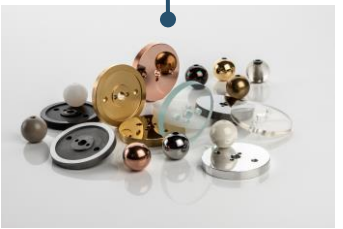
Interactions occur between:

Teeth – Teeth	Tongue – Bolus
Tongue Palate	Lips
Tongue – Teeth	Lips – Food
Teeth – Food	Bolus – Palate
Tongue - Food	Food Particles – Oral Surfaces

PCS Instruments can supply a wide range of specimens to allow different oral interactions to be studied

Including:

- PDMS (Duro 30)
- PDMS (Duro 50)
- Glass
- + …



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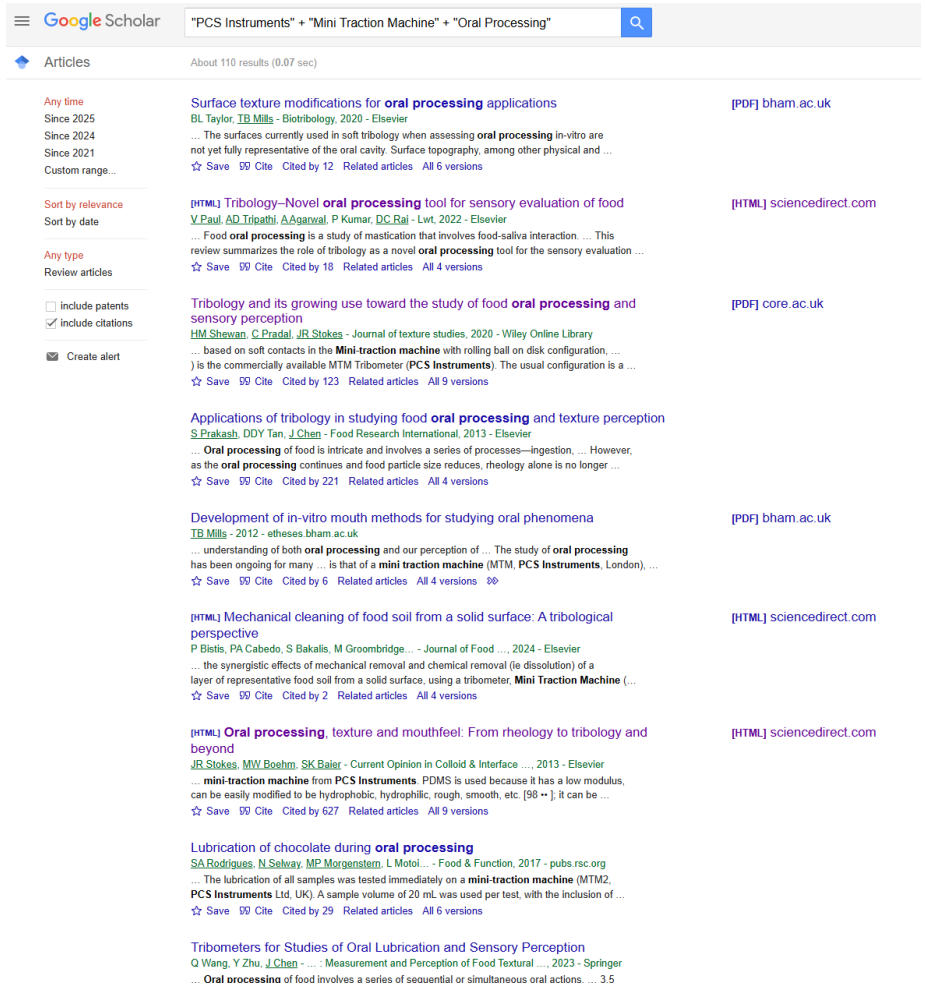
MTM – Oral Processing

Google Scholar:

"PCS Instruments" + "Mini Traction Machine" + "Oral Processing"

= 110 results



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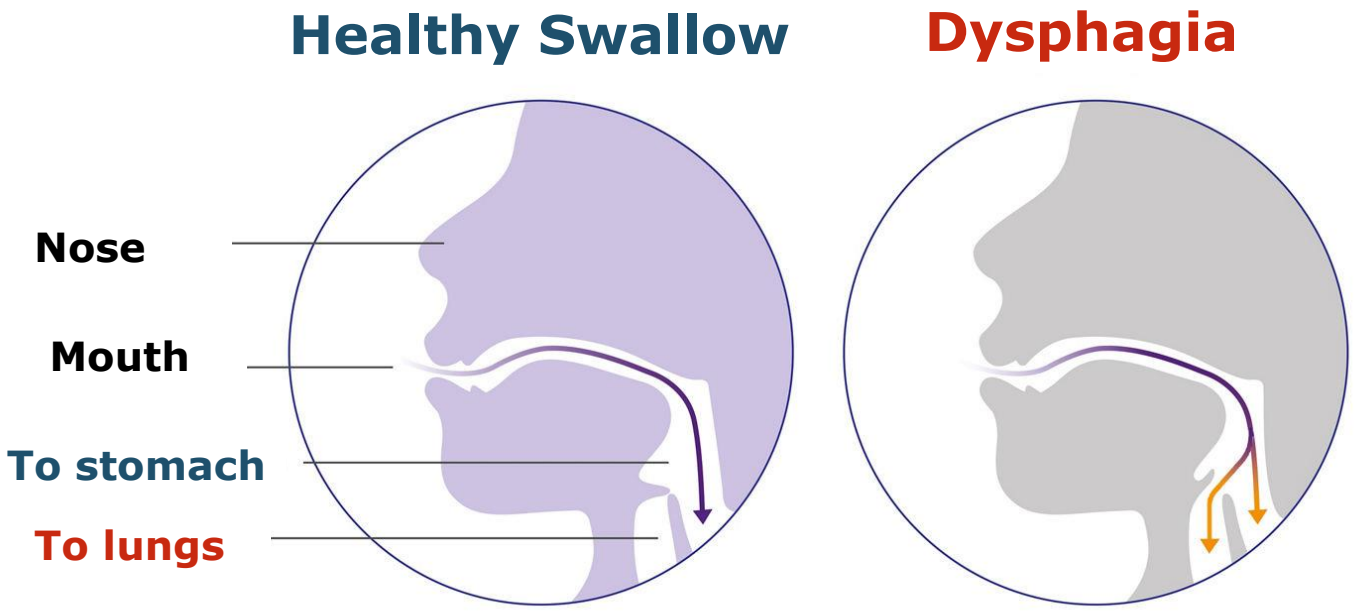
MTM – Oral Processing - Thickeners for Dysphagia



= Aspiration (Choking)

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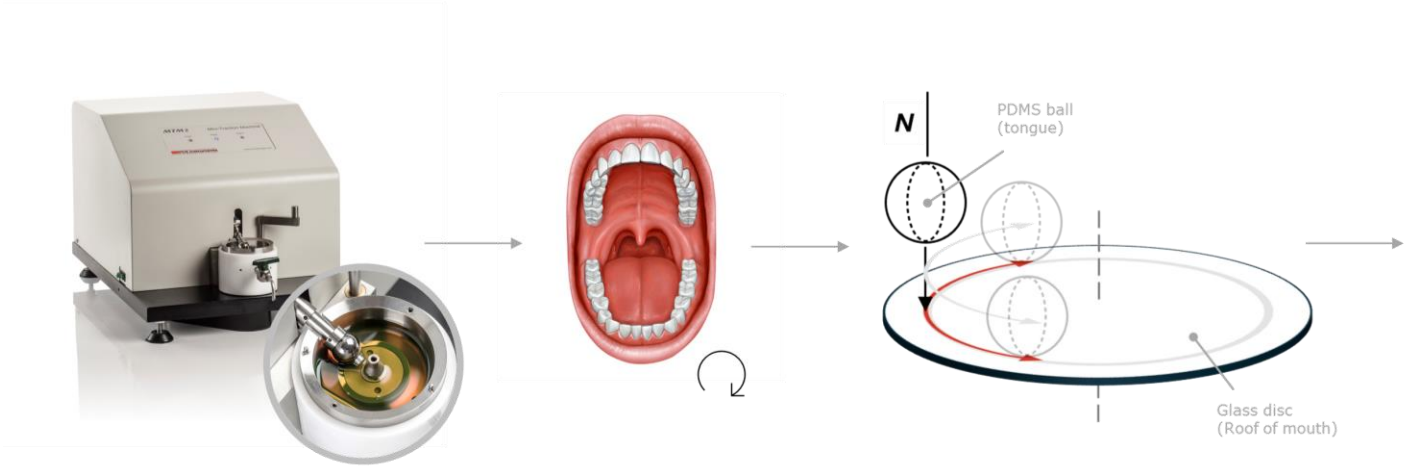
MTM – Oral Processing - Thickeners for Dysphagia



	Tongue-palate	Test Conditions
Normal Load	-	1N
Contact Pressure	5 kPa to 35 kPa	123 Kpa
Stroke Length	-	16 mm
Frequency	-	0.8 Hz
Mid-Stroke Speed	2 mm/s to 35 mm/s	25 mm/s
Temperature	36 °C to 37.5 °C	Ambient
Sampling Rate	5 Hz to 50 Hz	50 Hz

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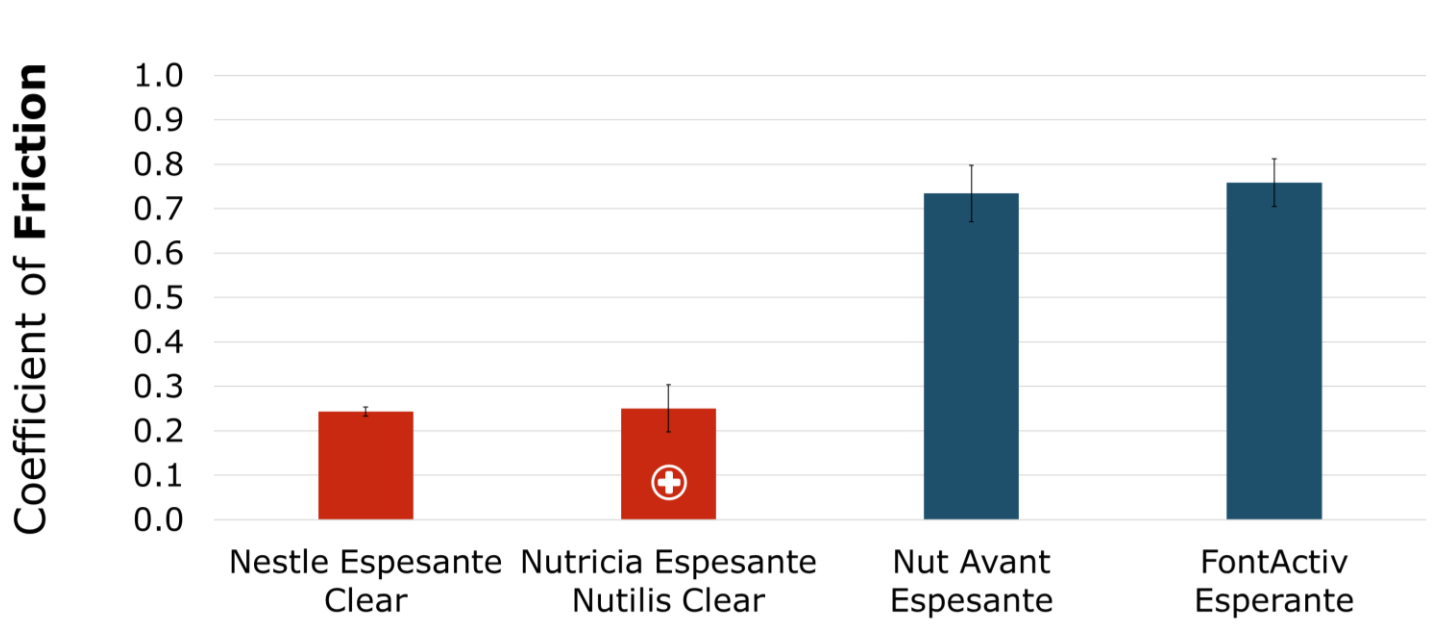
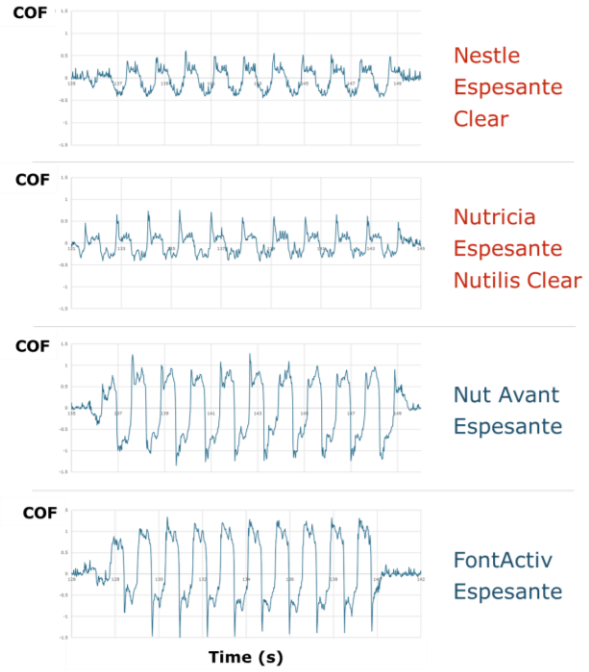
MTM – Oral Processing - Thickeners for Dysphagia





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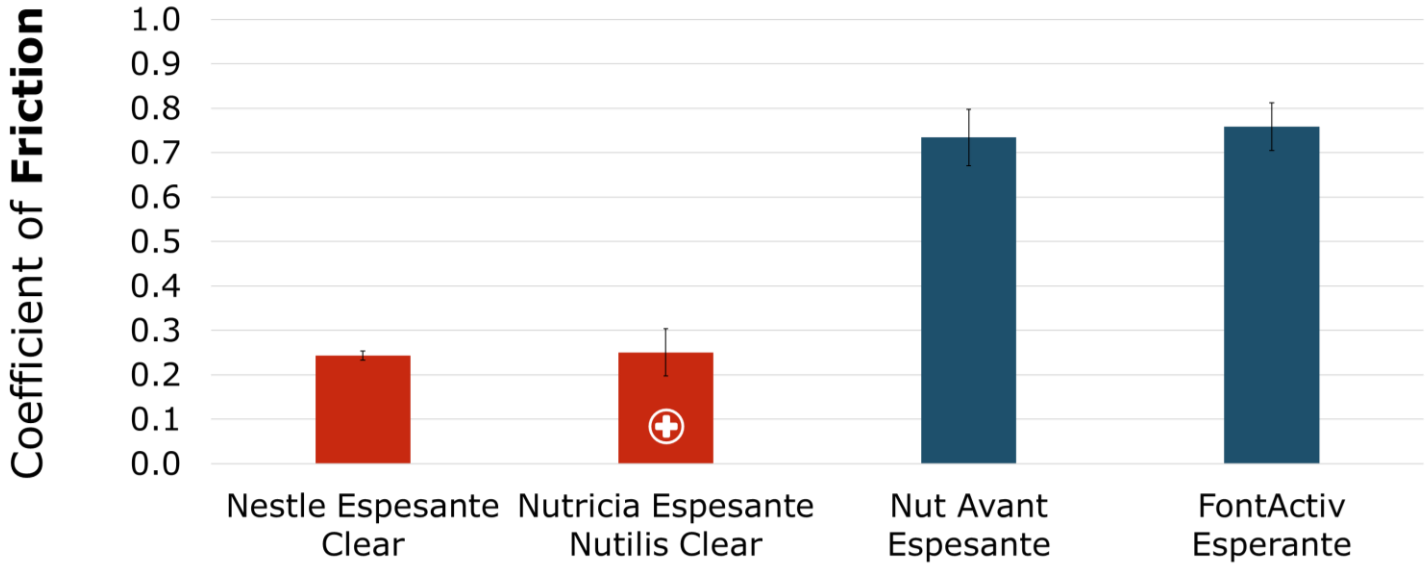

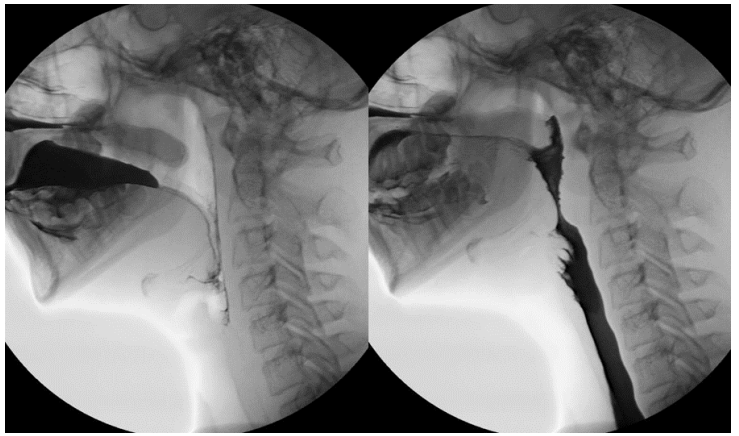

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MTM – Sensory Perception

Sensory Perception

Typical vocabulary used to describe the different characteristics of food

AROMA (e.g.)

Citrus *Earthy* *Floral*

Fresh *Fruity*

Nutty *Smoky*

APPEARANCE (e.g.)

Evenness of colour *Colour* *Size*

Brightness *Clarity*

Consistency *Shape*

TASTE (e.g.)

Creamy *Bitterness* *Acidic*

Astringency *Buttery* *Piquant*

Fattiness *Chalky* *Tangy*

TEXTURE (e.g.)

Firm *Mushy* *Dry*

Flaky *Hard* *Fluffy*

Crumbly *Sticky* *Smooth*

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MTM – Sensory Perception

Google Scholar:

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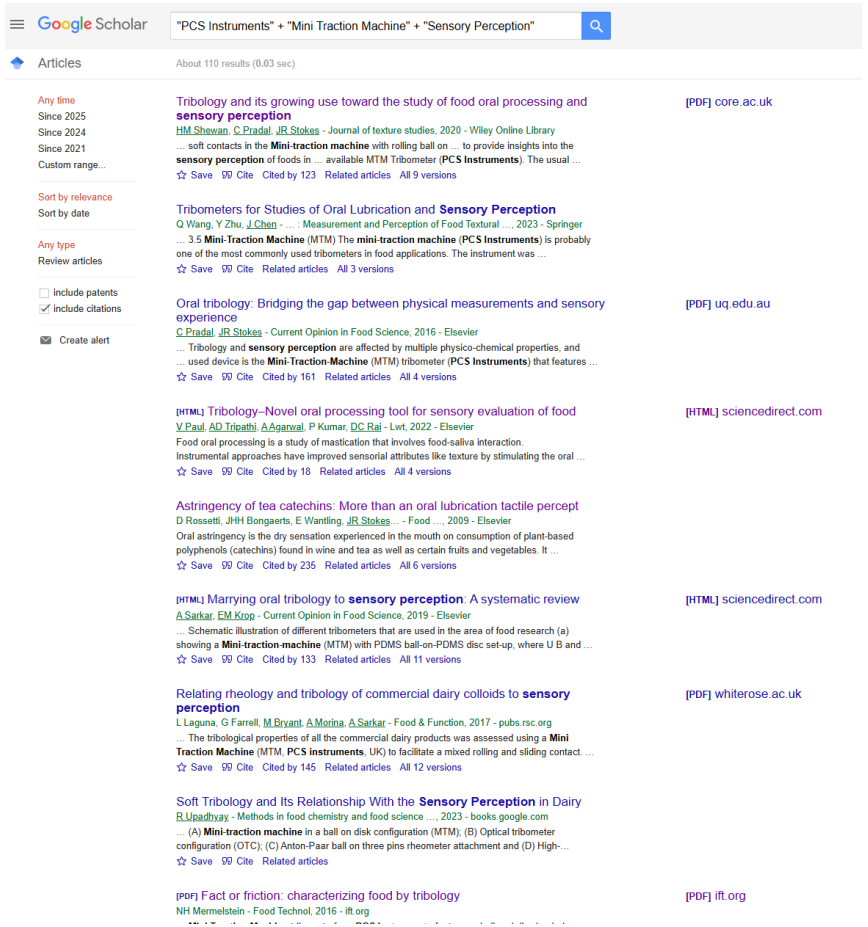

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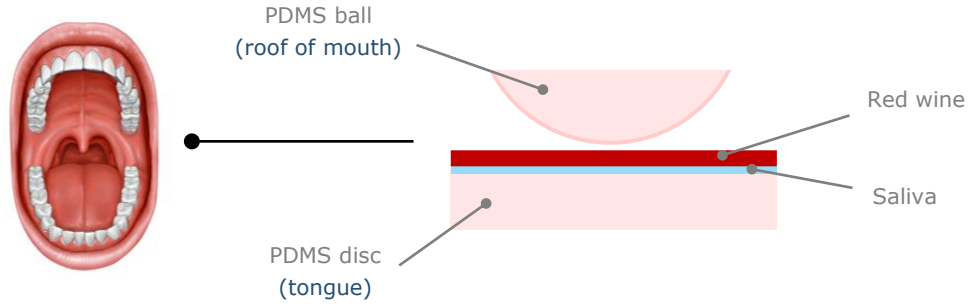
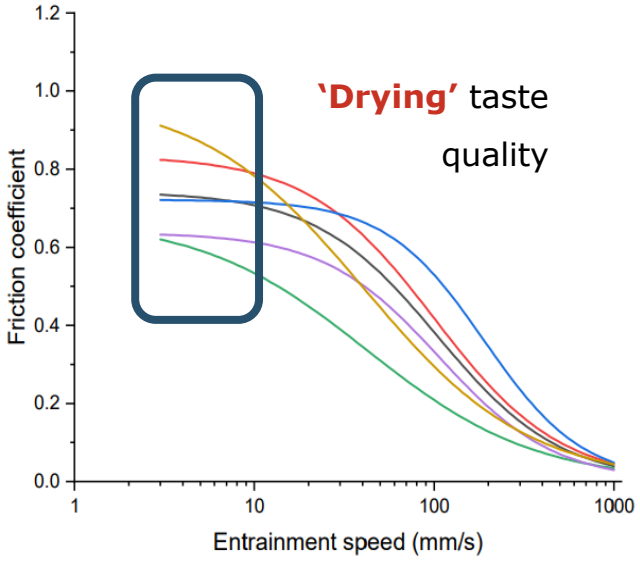
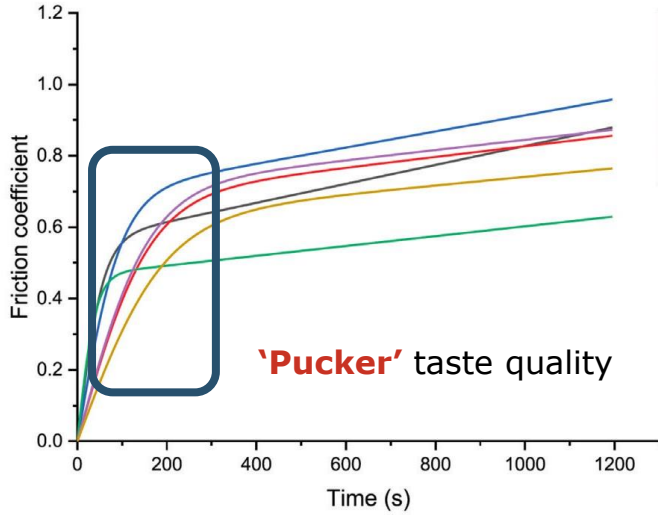
MTM – Sensory Perception - Wine







Wang, S., Olarte Mantilla, S. M., Smith, P. A., Stokes, J. R., & Smyth, H. E. (2020).

Astringency sub-qualities drying and pucker are driven by tannin and pH–insights from sensory and tribology of a model wine system.

Food Hydrocolloids.

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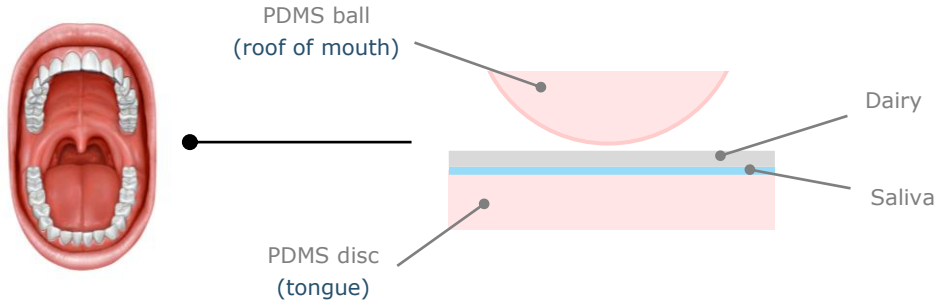
MTM – Sensory Perception – Dairy Products

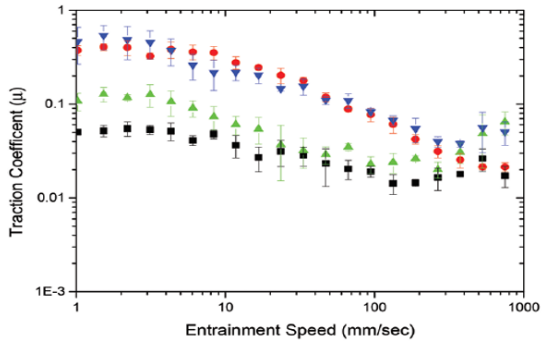


Laguna, L., Farrell, G., Bryant, M., Morina, A. and Sarkar, A. (2017).

Relating rheology and tribology of commercial dairy colloids to sensory perception

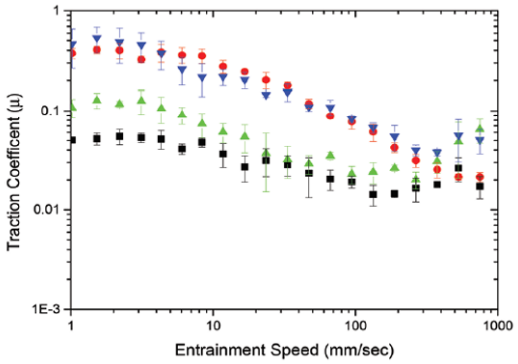
Food & Function

Yoghurt



- Full Fat
- Fat Free
- Full Full + Saliva
- Fat Free + Saliva

Cream Cheese



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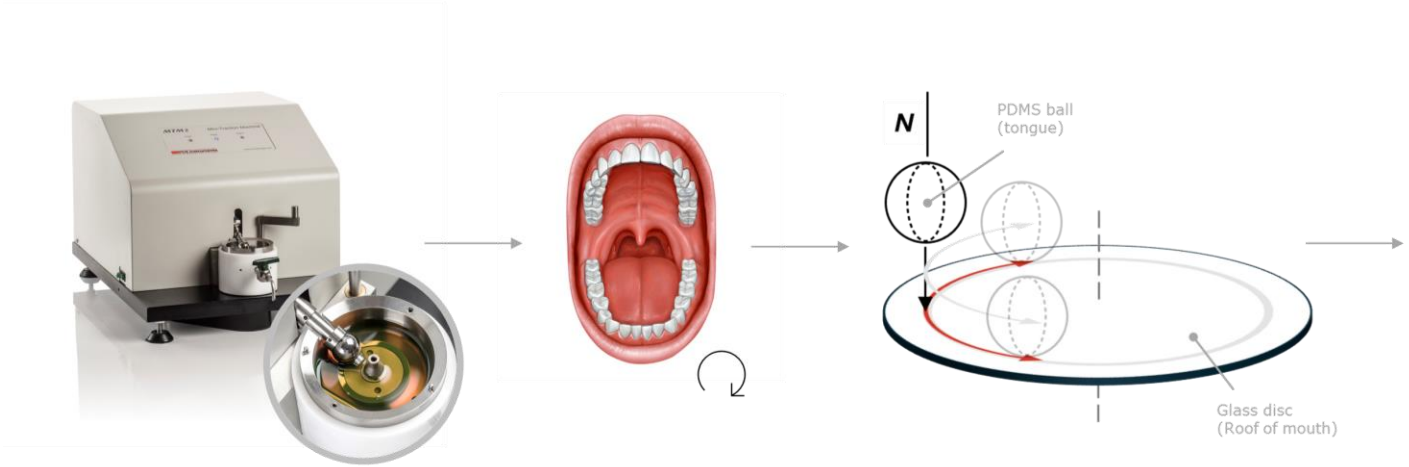
MTM – Sensory Perception - Yoghurts



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Stroke Length	-	16 mm
Frequency	-	0.8 Hz
Mid-Stroke Speed	2 mm/s to 35 mm/s	25 mm/s
Temperature	36 °C to 37.5 °C	Ambient
Sampling Rate	5 Hz to 50 Hz	50 Hz

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MTM – Sensory Perception - Yoghurts

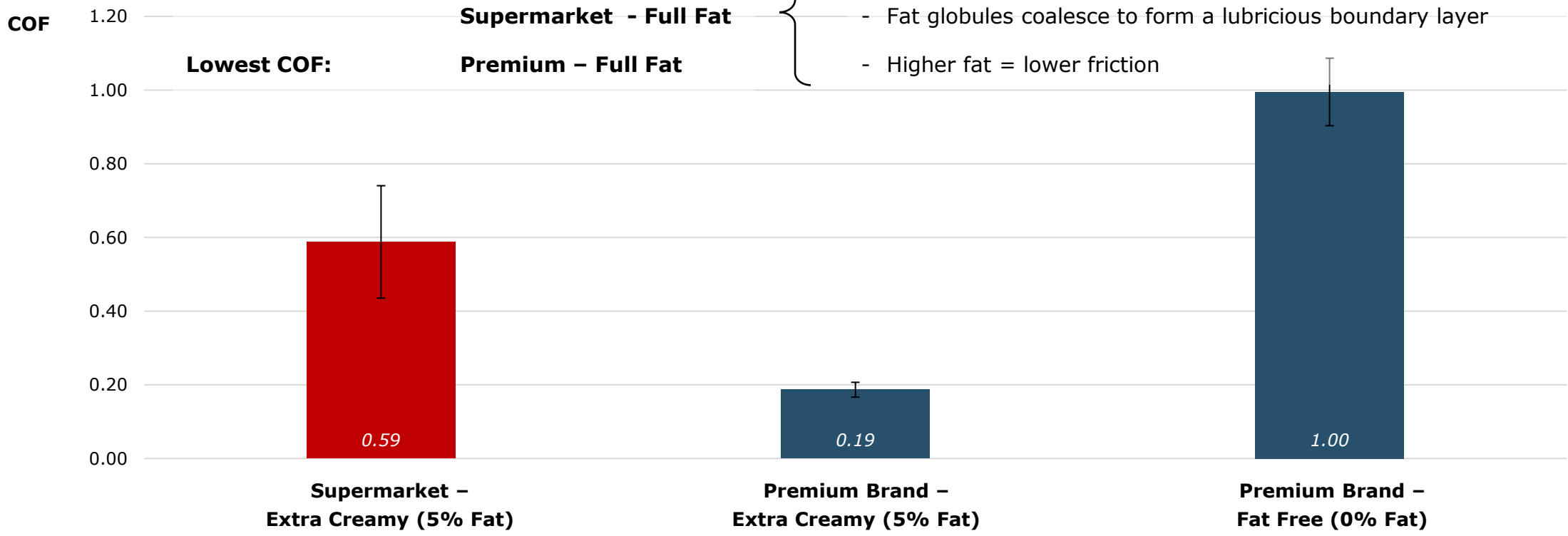
Highest COF: **Premium – Fat Free**

Supermarket - Full Fat

Lowest COF: **Premium – Full Fat**

Good agreement with literature:

- Fat globules coalesce to form a lubricious boundary layer
- Higher fat = lower friction



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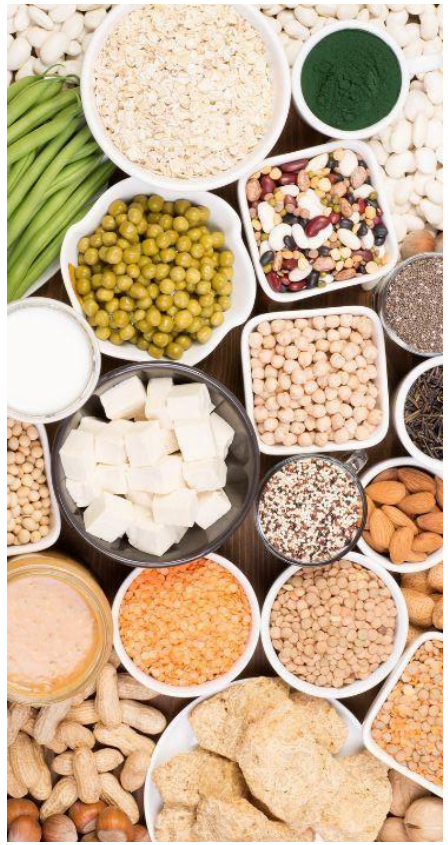
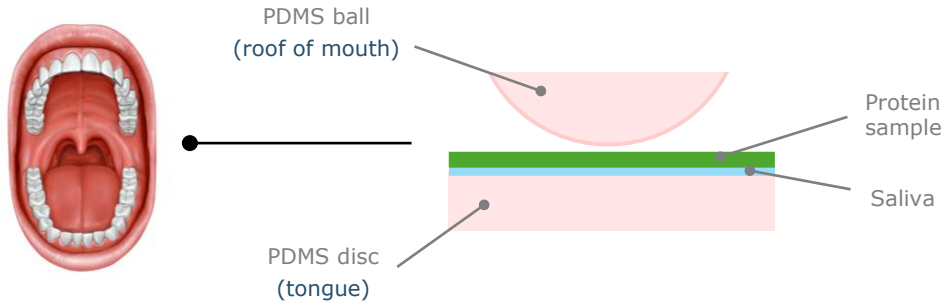
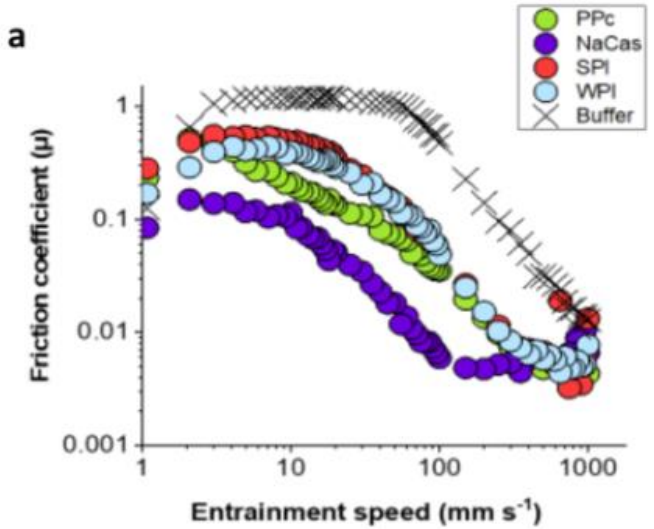
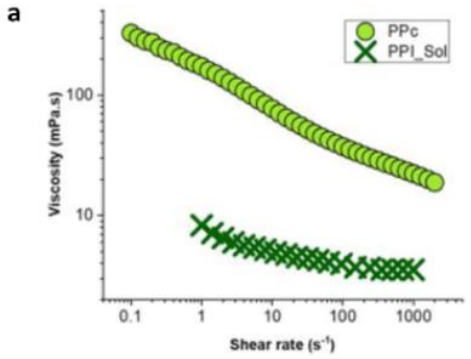
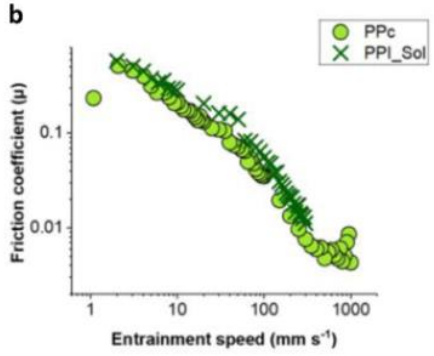
MTM – Sensory Perception – Alternative Proteins











Brown. F, Soltanahmadi. S, . Mackie A.R., He. Q, Pfeifer. J, Sarkar. A,

(2025).

Comparing frictional behaviour of plant and dairy proteins: Case study on high protein concentration

Food Research international.

Tribology ~~&~~ **Viscosity**

PCS Instruments

HFRR

A ball-on-disc, high-frequency, reciprocating instrument for assessing the lubricity of both fuels and lubricants under boundary conditions.

Relevant Industries:

- Food & Beverage
- Biomedical
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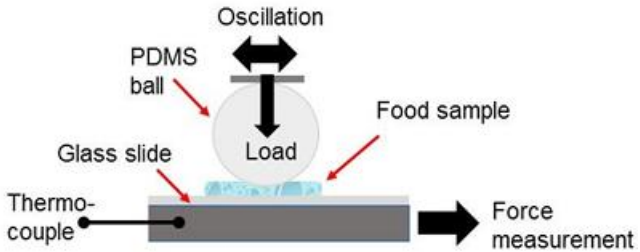
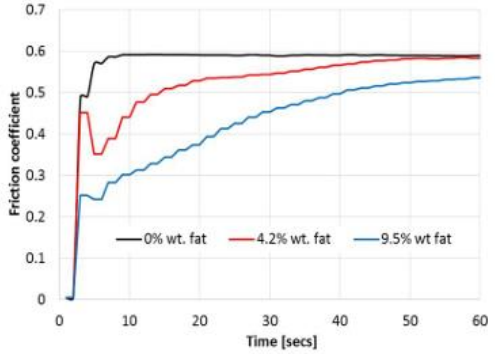
HFRR – Sensory Perception - Yoghurts



Test condition	
Specimens	PDMS 19 mm dia ball Glass microscope slide
Test fluids	Yoghurt: 0, 4.2, 9.5 wt. % fat
Reciprocating sliding test	2N load 10 Hz, 1 mm stroke length, 60 secs rubbing

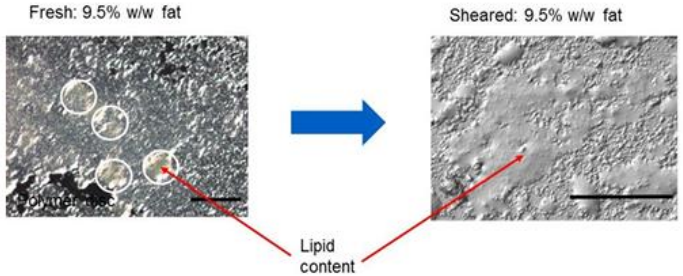
RESULTS



Friction increase as the film breaks down: delayed for higher fat content

Enhanced mouthfeel attributes?

Friction change with rubbing time for different fat-content yoghurts



Changes to the structure and distribution of dairy food components

DIC optical images of fresh and rubbed yoghurt films

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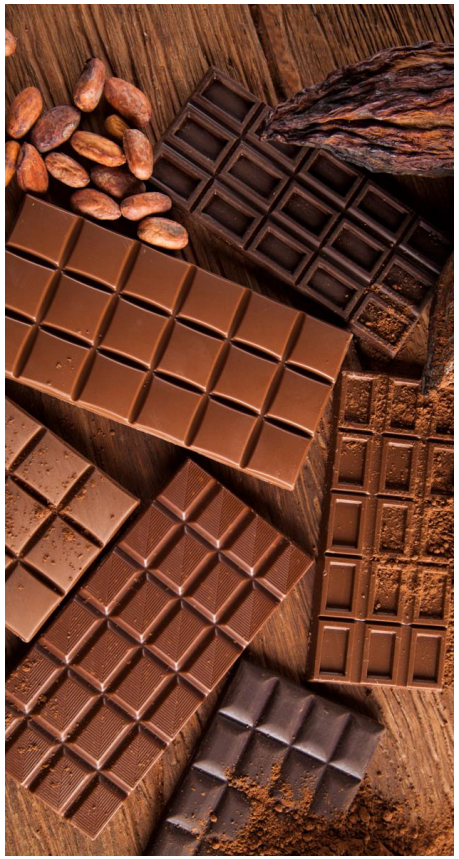
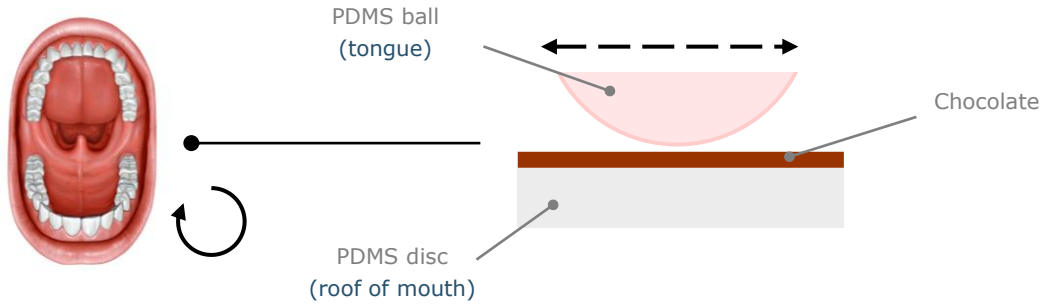
HFRR – Sensory Perception – Chocolate



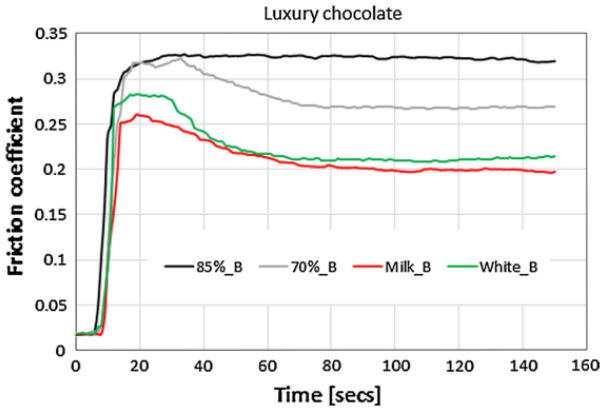


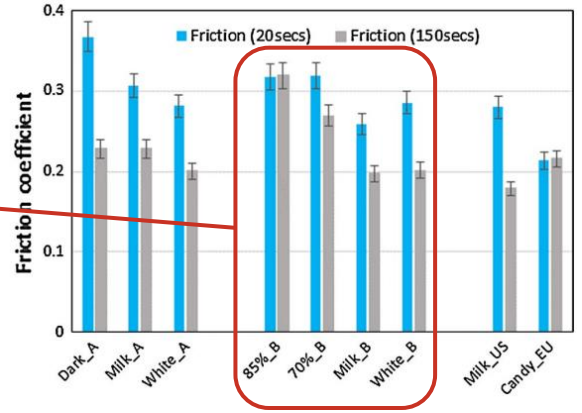
Masen. M, P.M.E. Cann

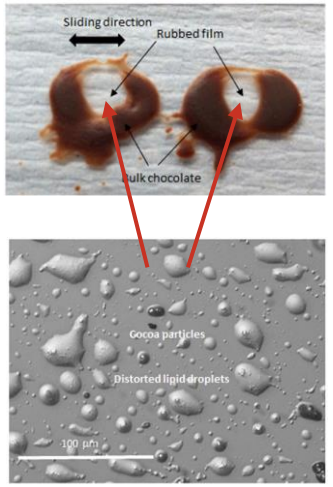
(2017).

Friction Measurements with Molten Chocolate

Tribology Letters







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