



The Science Behind IDDSI

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1



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The International Dysphagia Diet Standardisation Initiative is supported by funding from a variety of industry sources.

2

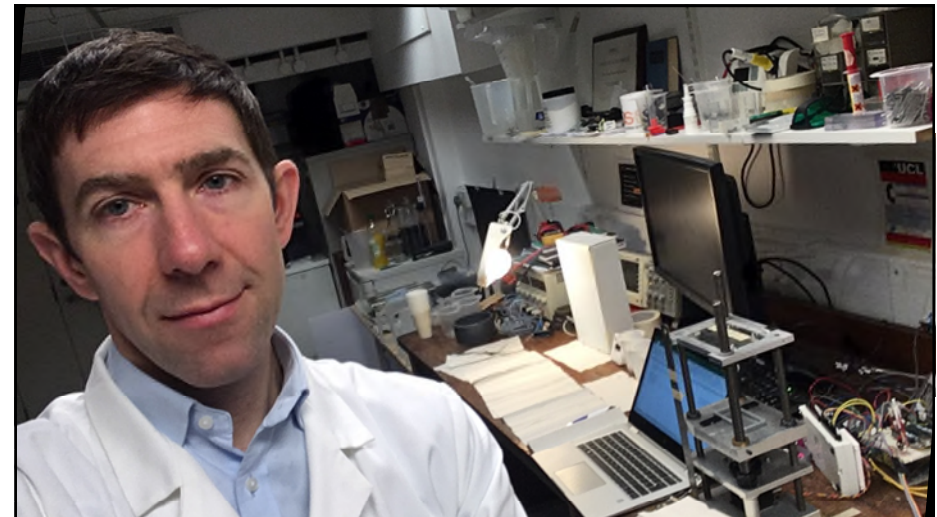
SAFETY AND QUALITY OF LIFE

For all ages, all care settings, all cultures





3



4

“Large” can be quantified in millilitres

**But: How thick is “thick”?
and: What do you mean, “thick”?!**

5

THE STORY OF IDDSI...

International best practice and web-based surveys

Scientific research

Multidisciplinary, international volunteer board

World Health Organization **NICE** National Institute for Health and Care Excellence **EUROPEAN COMMISSION** **AMERICAN COMMISSION ON FOOD AND DRUG ADMINISTRATION** **NHMRC** **SIGN**

6

BEST PRACTICE CREATING INTERNATIONAL GUIDELINES

2013: Establish Multidisciplinary Guideline Development Group

2014: Clear identification of clinical issues

2015: Involve consumers

2016: Systematic review + appraisal of literature

Consultation beyond the Multidisciplinary Development Group

Process for drafting the recommendations of the multidisciplinary Guideline Development Group

Turner et al. (2008), Implement Sci, 3:45; Qaseem et al. (2012), Ann Intern Med., 156: 525-531

World Health Organization **NICE** National Institute for Health and Care Excellence **EUROPEAN COMMISSION** **AMERICAN COMMISSION ON FOOD AND DRUG ADMINISTRATION** **NHMRC** **SIGN**

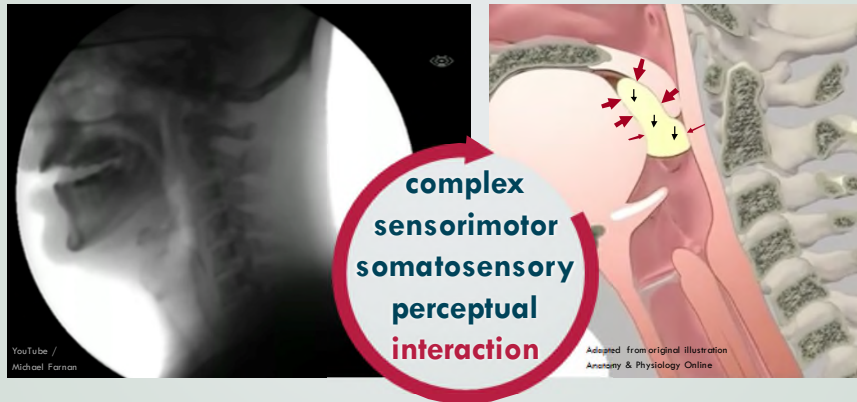
7

THE BIRTHPLACE OF THE FRAMEWORK

World Health Organization **NICE** National Institute for Health and Care Excellence **EUROPEAN COMMISSION** **AMERICAN COMMISSION ON FOOD AND DRUG ADMINISTRATION** **NHMRC** **SIGN**

8

INTERACTIONS DURING SWALLOWING



9

WHAT REALLY GOES ON IN THE MOUTH ?



Difficult to measure in-vivo (ultrasound, MRI, VFSS)



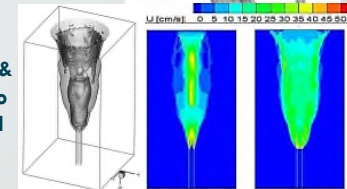
Burtidge et al. "A Day in the Life of the Fluid Bolus", Applied Rheology 26 (2016)

Difficult to simulate too...



Robbins et al. Arch Phys Med Rehabil 88, February (2007)

... anatomy & fluids need to be simplified



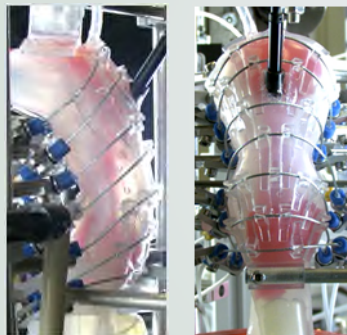
Preciado-Mendez et al., "Numerical analysis of extensional flow through the pharyngeal duct", IOP Conf. Series: J. Physics: Conf. Series 790 (2017)

10

MECHANICAL SIMULATION EXAMPLES



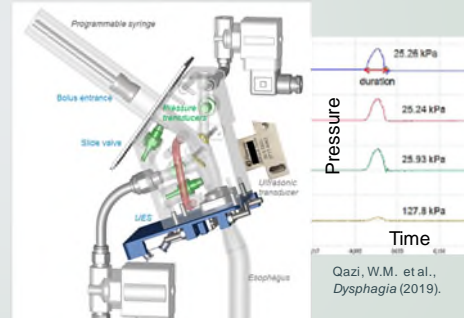
Swall-E: A robotic in-vitro simulation of human swallowing



Fujiso et al. (2018) PLoS ONE 13(12): e0208193

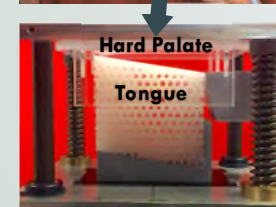
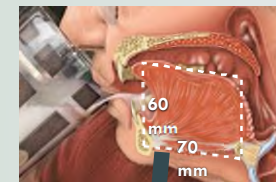
Gothemburg throat:

- Bolus injected and flows by gravity
- Bolus velocity measured by Doppler u/s

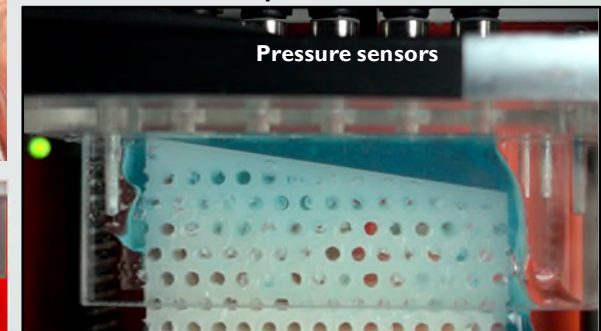


11

MECHANICAL ORAL SIMULATOR AT UCL



Slow motion: 1/20th speed

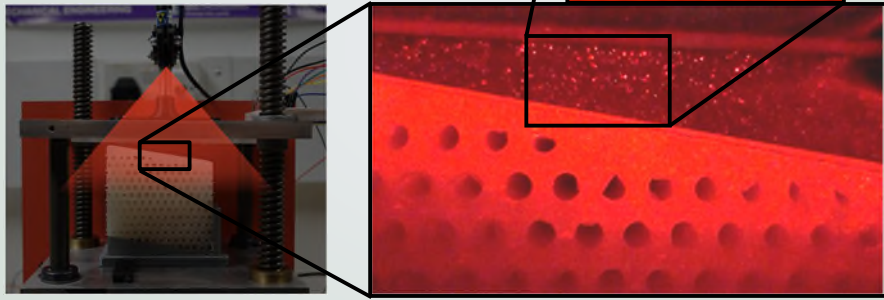


Redfean, A., Hanson, B., IEEE/ASME Transactions on mechatronics 23(2) 2018

12

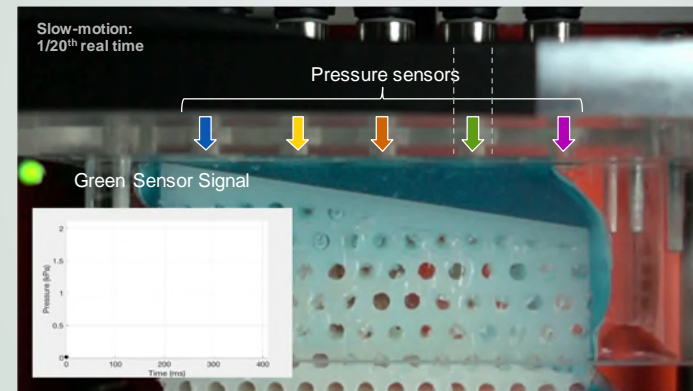
PARTICLE IMAGE VELOCIMETRY

- Non-invasive measurement of flow field
- Flow is not uniform



13

PALATAL PRESSURE SENSING



14

CLINICAL EVIDENCE: LIQUIDS

1. Thickened liquids helps those who **aspirate** thin liquids
2. Liquids can be “**too thick**”, where residue begins to accumulate ...and drinks become **less appealing!**



Systematic reviews: Newman, 2016, *Dysphagia*, 31: 232-49;
Steele et al., 2015, *Dysphagia*, 30: 2-26

Ongoing research required to determine *therapeutic thickness levels*

15

THE IDDSI FRAMEWORK:



- Peer-review published¹ in Nov. 2015 (**Revised: July 2019**)
- A continuum of 8 levels (0-7)
 - Spanning foods and drinks
- Colour-coded
- Culturally-neutral
- Includes **descriptors**, **testing methods** and **evidence** for foods and drinks



¹ Cichero, J.A.Y., Lam, P., Steele, C.M. et al. *Dysphagia* (2017) 32: 293.

16

MEASUREMENTS: LIQUIDS

PRE-EXISTING VISCOSITY MEASURES



NDD	0-50 cP*	51-350 cP*	351-1750 cP*	> 1750 cP*
AU proposed	< 95 mPa.s* (<1.3 Pa)#	95-200 mPa.s* (1.3-4.0 Pa)#	260-550 mPa.s* (5.5-11.5 Pa)#	670-1040 mPa.s* (14-21 Pa)#
JPN	<50 mPa.s*	50-150 mPa.s*	150-300 mPa.s*	300-500mPa.s*
				>500 mPa.s*

* Viscosity @ 50 sec⁻¹ shear rate;
Yield stress (Pa)

American Dietetic Association (2002); Hadde (2015) Int J Speech-Lang Pathol, 18:402-410; Watanabe et al.(2017) Dysphagia, epub ahead of print

VISCOSITY IN DETAIL...



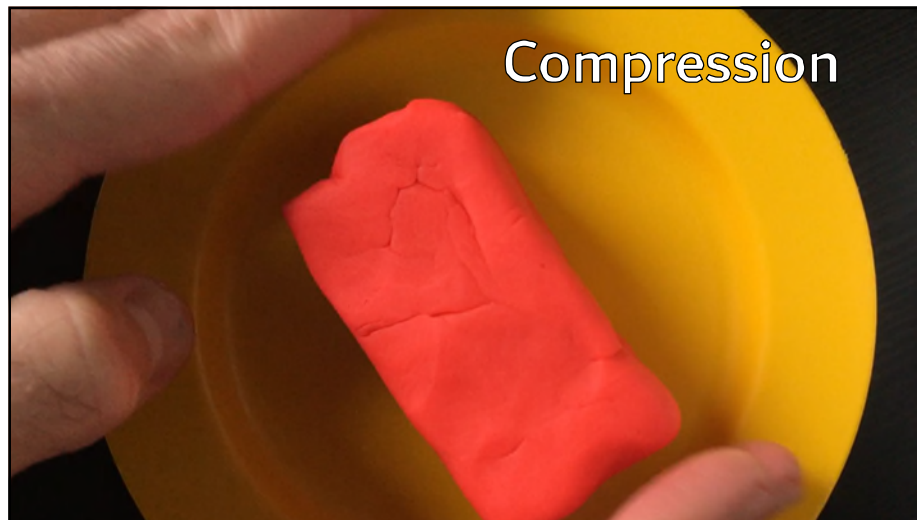
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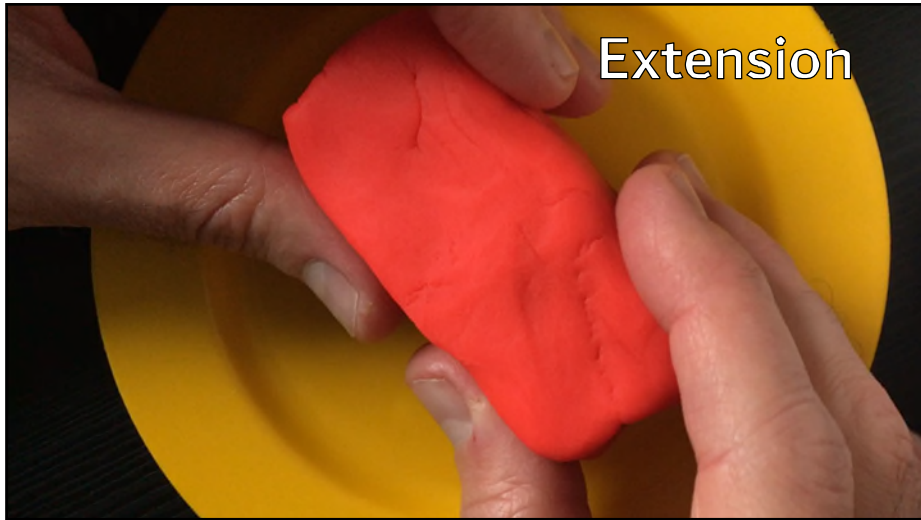
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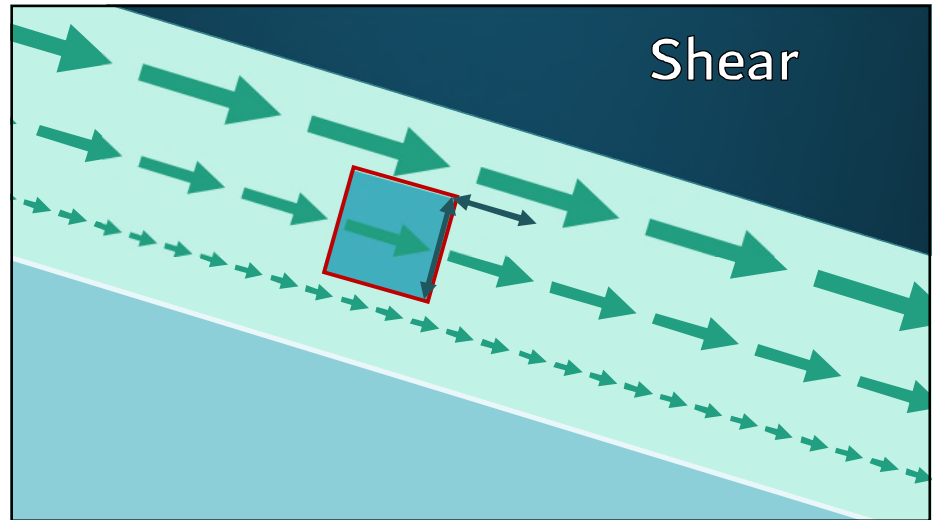
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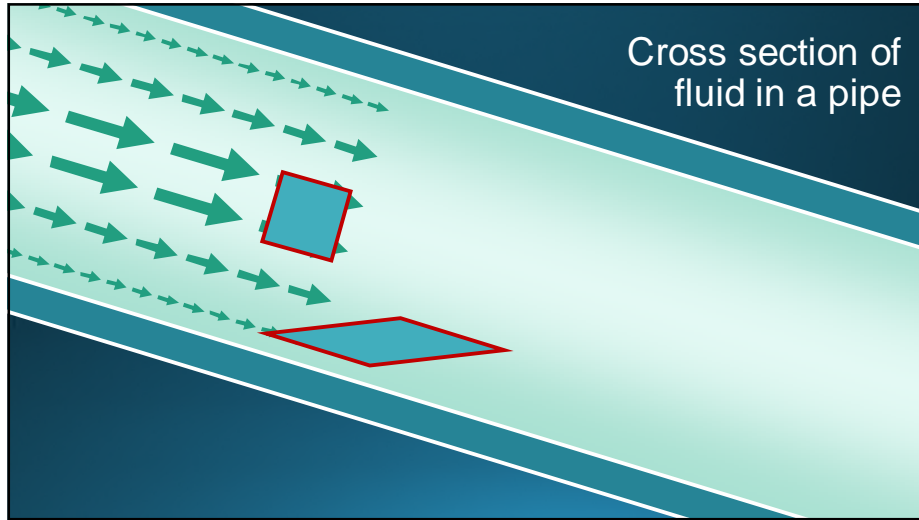
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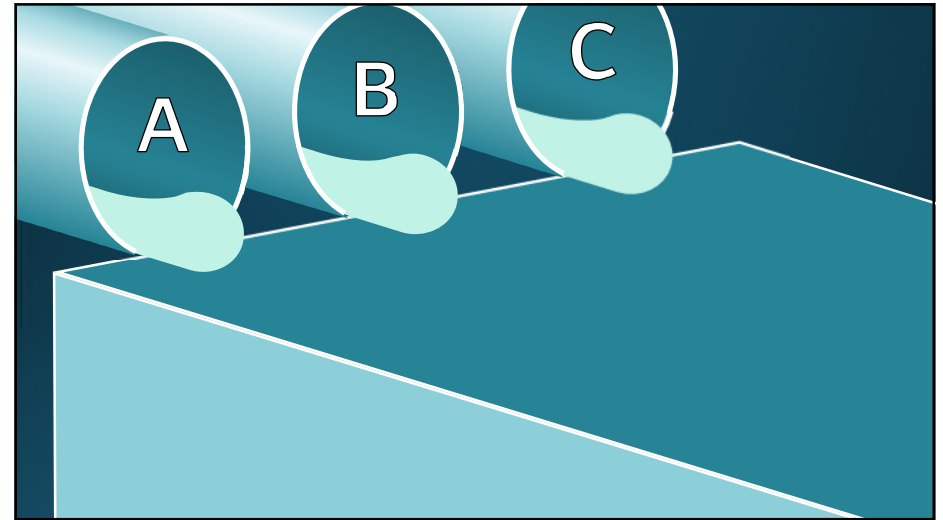
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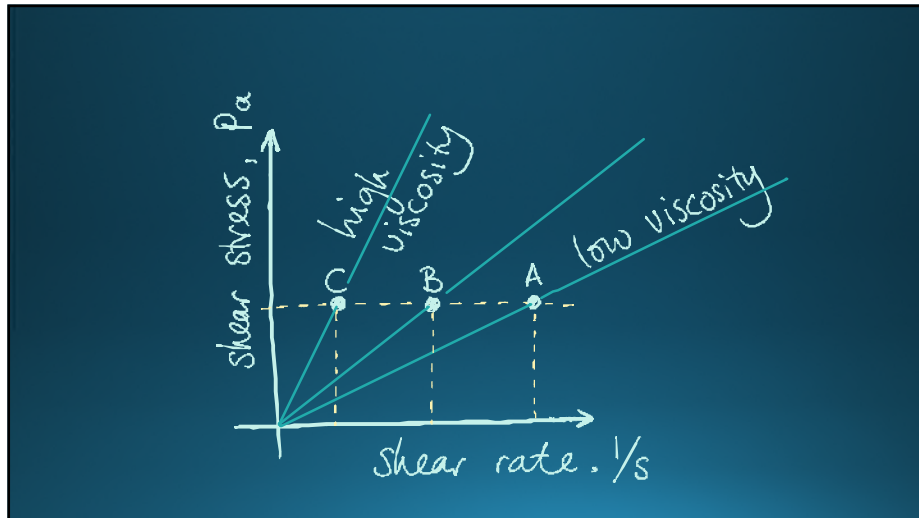
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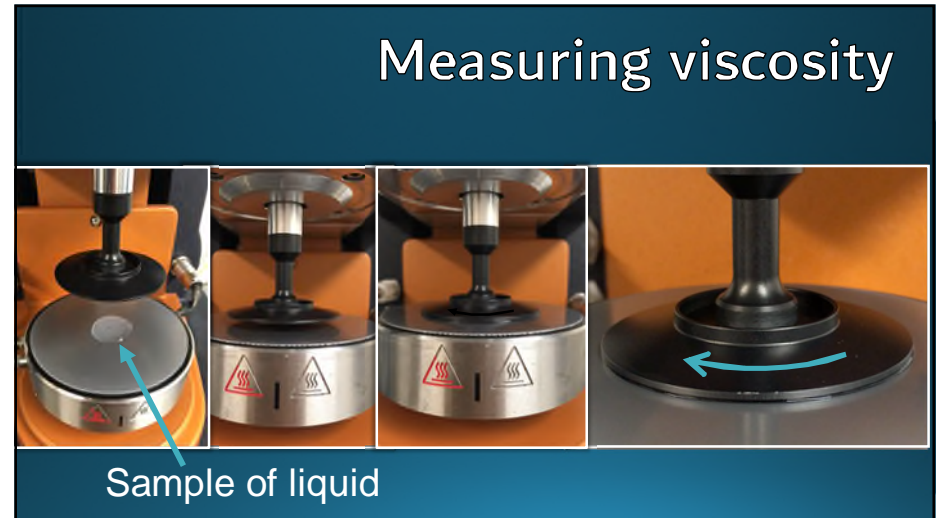
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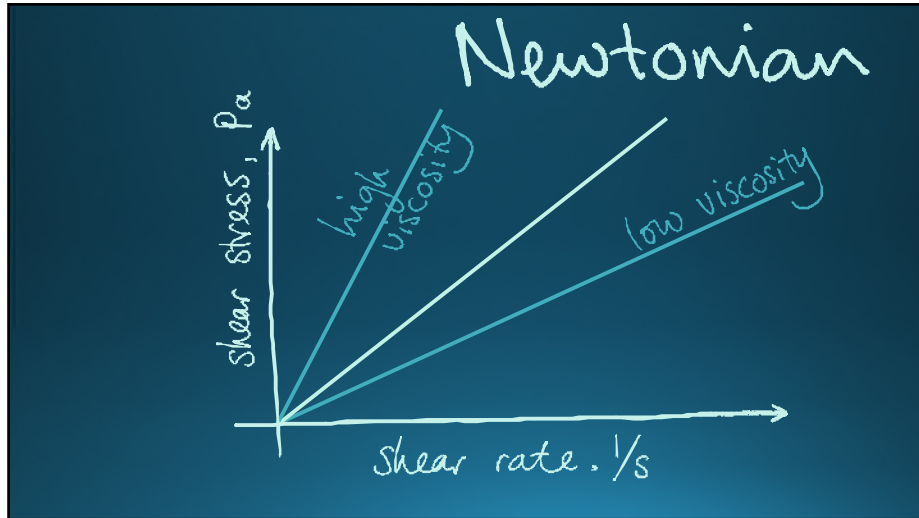
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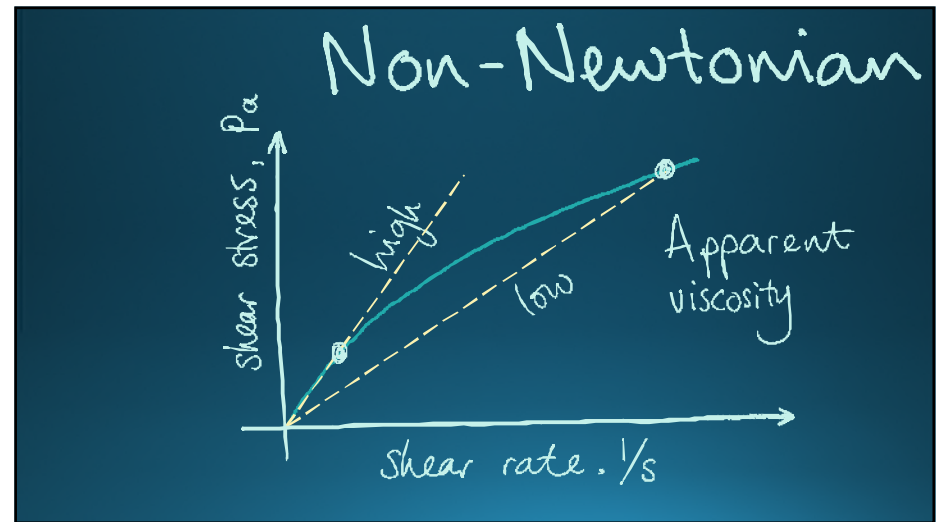
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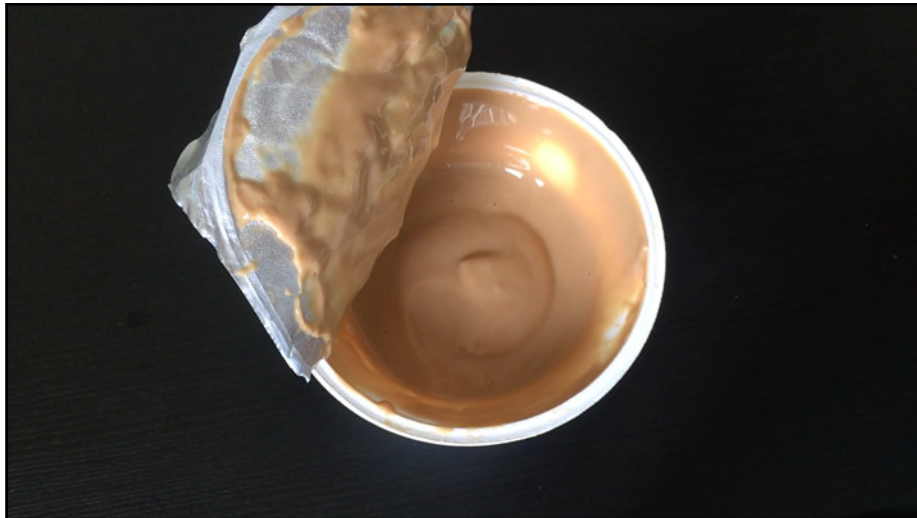
34



35



36



37



38

METHODS FOR ASSESSING “THICKNESS”

Practicality, affordability ↑

Accuracy, Reproducibility ↓

- Verbal descriptions of thickness
 - unspecific and highly subject to interpretation
- Swirling in a cup, Pouring from a spoon
 - Can be performed in comparison with a “reference” liquid (e.g. pre-thickened O.N.S., or “TIM tubes”¹⁾)
- Consistometer, Line-spread test²⁾, or Funnel flow test
 - Useful for local audit of repeatability
- Viscometer
 - Results dependent on technique and measurement parameters (geometry, speed)
- Rheometer
 - “Complete” measurement of a small sample of homogeneous material in controlled conditions

1) Chadwick et al. J Intellectual Disability Research (2013)
2) Masters Lund, Mertz Garcia, Chambers, Am J Speech Lang Path (2013)


39

RHEOLOGICAL MEASUREMENT

Practicality, affordability ↑

Accuracy, Reproducibility ↓

Scalar “viscosity” is too **simplicistic** to describe foods and drinks, which are non-Newtonian.



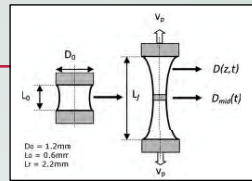
Horizontal lines indicate manufacturer specified viscosity for each thickness

O’Leary et al. (2010) J. Food Science, 75:E330-E338

40

ACCESSIBILITY vs VALIDITY

- Measurements need to represent *in-vivo* flow
- Bostwick & line spread test “slump”
- But swallow involves shear & extension



Mackey et al. (2013) J. Rheology, 57: 1533



41

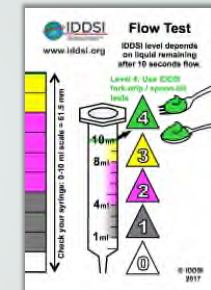
1 SLIGHTLY THICK



IDDSI - Flow Test

Level 1

1 SLIGHTLY THICK



1-4 ml remaining after 10 seconds flow

42

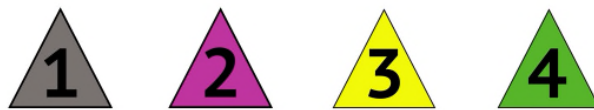
THE FLOW TEST

4 consistencies shown here
(Level 4 needs fork & spoon tests)

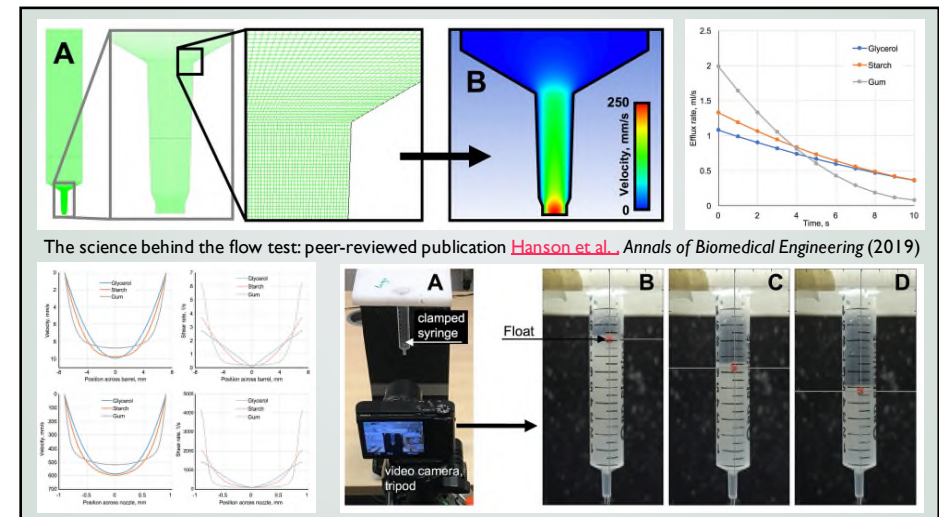


IDDSI - Flow Test

Comparison of level 1-4



43

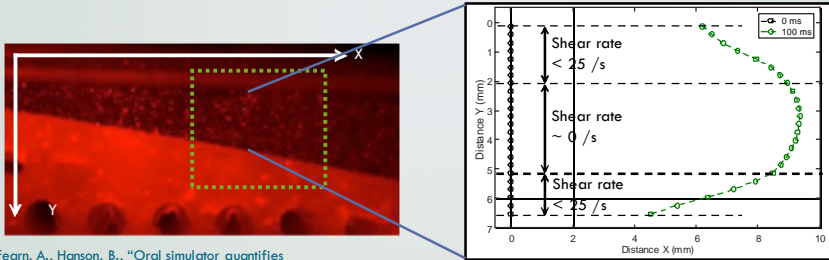


44

SHEAR RATES



- Shear rate highest at the boundaries (tongue and palate)
- Zero in the centre of flow
- True for non-turbulent flow in any channel



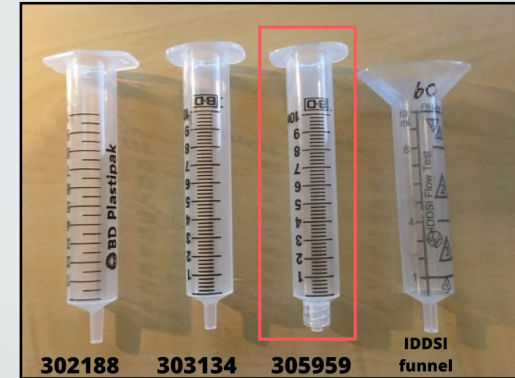
Redfean, A., Hanson, B., "Oral simulator quantifies intra-bolus pressures, flow speeds..." DRS (2017)

45

USE THE CORRECT SYRINGE



- **Incorrect** sized syringes give incorrect measurements
- The difference is **unpredictable**, depending on the liquid type
- **IDDSI flow test funnels** may be the solution.



46

METHODS FOR ASSESSING "THICKNESS"



Practicality, affordability ↑

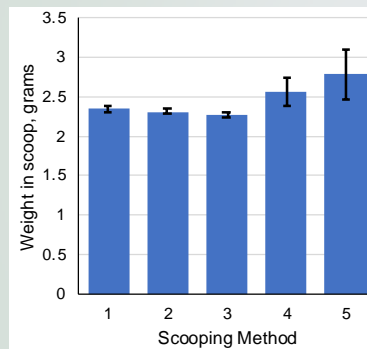
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Accuracy, Reproducibility ↓

1) Chadwick et al. J Intellectual Disability Research (2013)
 2) Masters Lund, Mertz Garcia, Chambers, Am J Speech Lang Path (2013)

47

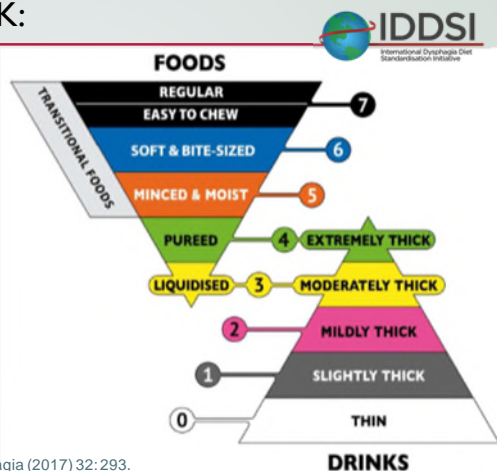
VARIABILITY IN SCOOP VOLUME & MASS



48

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¹ Cichero, J.A.Y., Lam, P., Steele, C.M. et al. *Dysphagia* (2017) 32:293.

49

EVIDENCE: FOODS

1. **Solid food and thick/paste** consistencies = **greater effort** in oral processing and swallowing
2. Very little published about texture modified food used for dysphagia management

Systematic review
Steele et al., 2015, *Dysphagia*, 30:2-26



- **ETHICS** - RCT studies unsafe if a potential outcome is death by choking
- Autopsy data: Particle size and specific food textures identified that increase choking risk

50

MEASUREMENTS: FOODS

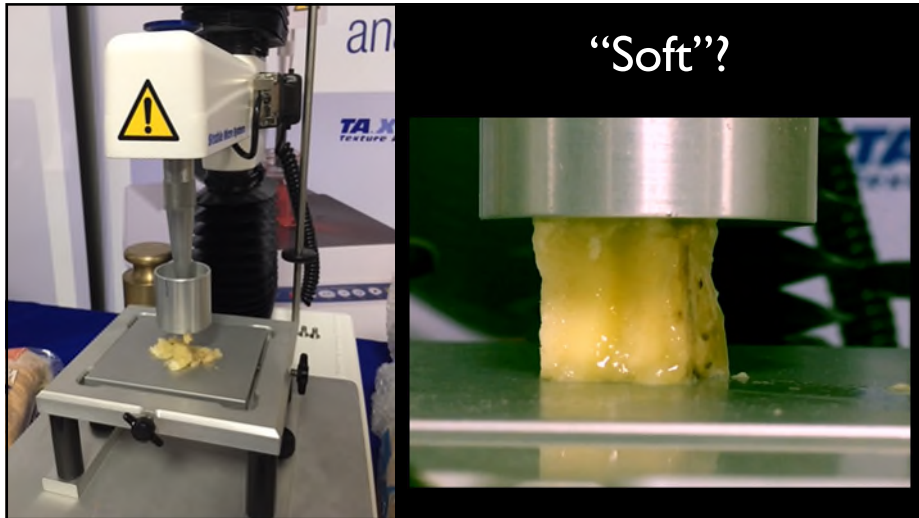
51

LEVEL 7 EASY TO CHEW (L7EC)

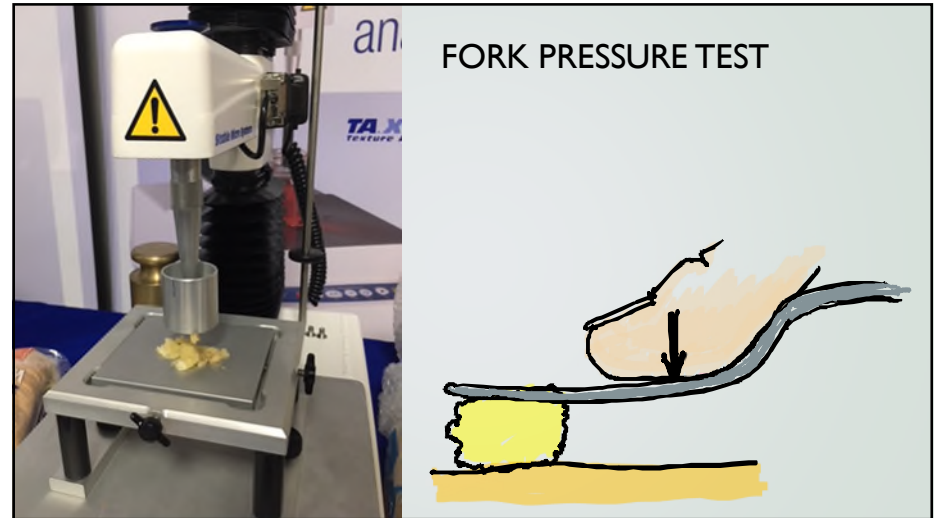
“Soft”



52





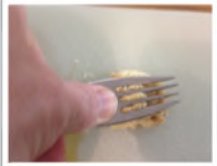
53






54

FORK PRESSURE TEST






Sample squashes and does not return to its original shape when pressure is released


Thumb nail blanched to white

55

AUTOPSY EVIDENCE: PARTICLES




Minimise choking risk: Food pieces small enough to **pass through**, rather than **block** the airway



Tracheal diameter ranges

Pediatrics:
20 months, 4-6.5mm
18-36 months, 7-8mm

Adult male, 15-27mm
Adult female, 13-25mm



Textures & shapes that increase choking risk: stringy, crunchy, crumbly, hard or dry, floppy, fibrous, 'tough', skins, shells, round shape, long shape, husks, mixed consistencies

56

6 SOFT & BITE-SIZED



- ✓ Bite-sized pieces of
 - ✦ 1.5 x 1.5cm for adults (~thumb nail size)
 - ✦ 8mm x 8mm for children
- ✓ Chewing is necessary
- ✓ Tongue strength and control needed to move food for chewing and for swallowing



Press with your thumb just hard enough to blanch your thumbnail
Food should squash easily and not return to its original shape

57

CHEWED FOOD (GROSS-OUT WARNING...)

Journal of **Texture Studies**
Journal of Texture Studies ISSN 1745-4603

EXPLORING THE LINKS BETWEEN TEXTURE PERCEPTION AND BOLUS PROPERTIES THROUGHOUT ORAL PROCESSING. PART 2: BOLUS MECHANICAL AND RHEOLOGICAL PROPERTIES

ASHLEY K. YOUNG^{1,3}, JEAN NE CHEONG², KYLIE D. FOSTER², DUNCAN I. HEDDERLEY², MARCO P. MORGENSTERN⁴ and BRYONY J. JAMES¹

Check for updates | Accepted 17 November 2020
DOI: 10.1111/jost.13351

ORIGINAL ARTICLE

Changes of bolus properties and the triggering of swallowing in healthy humans

Izumi Kochi¹ | Eri Takei² | Rumiko Maeda^{1,2} | Kayoko Ito³ | Jin Magara⁴ | Takanori Tsujimura² | Sirina Kulvanich⁴ | Makoto Inoue²

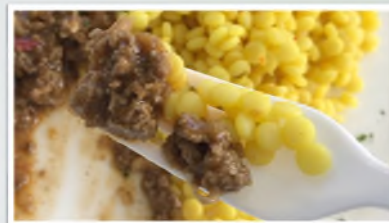
Chen J. Food oral processing—A review. Food Hydrocolloids. 2009;23(1):1-25.

58

5 MINCED & MOIST



- ✓ **Soft and moist** with no separate thin liquid
- ✓ Minimal chewing required
- ✓ Lumps can be mashed with tongue
- ✓ Food can be easily mashed with just a little pressure from a fork
- ✓ Should be able to scoop it onto a fork with no liquid dripping and no crumbles falling off the fork



4mm is the typical separation between the prongs of a fork

Small particle size
4mm for adults
2mm for children


59

COHESION



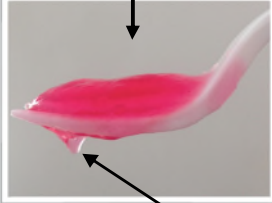
Turcanu, M., et al., The role of human saliva on the elongational... 5th IEEE International Conference on E-Health and Bioengineering - EHB 2015

60

4 EXTREMELY THICK 4 PUREED 

- ✓ No Lumps
- ✓ Does not require chewing
- ✓ Not sticky
- ✓ Holds shape on a spoon
- ✓ Falls off in a single spoonful when tilted and holds shape on plate with slight slumping or slow spreading


Extremely Thick liquid or Pureed Food **sits in a mound** or pile above the fork

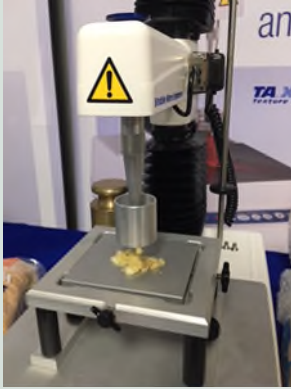


It does not dollop, flow or drip continuously through the fork prongs

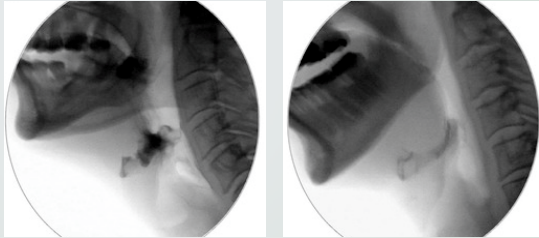
A **small amount** may flow through and form a tail below the fork

61

ADHESION 



- Stickiness is associated with residue



62

IDDSI SPOON TILT TEST 




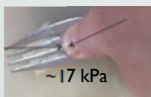
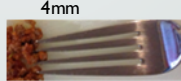

IDDSI Spoon Tilt Test determines Cohesion (ability to hold together) and Adhesion (stickiness)

For safety the bolus should be cohesive enough to hold its shape but not sticky

63

FOOD TEXTURES RELATE TO DEGREE OF ORAL PROCESSING

Food break-down process during chewing	A bite: A bite, or cut to enable comfortable chewing and oral manipulation	Chewed bolus: Cohesive, small particles held together with saliva	Ready to swallow: Smooth, lump free, moist (not sticky) bolus
Physiologic information from literature	15 x 15 mm Within tracheal size Pressure until thumb nail blanches to white	2-4 mm Relevant to particle size of chewed bolus	Smooth & moist Relevance to early oral sensory experiences + reduced choking risk

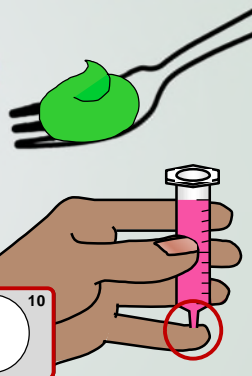





64

HOW TO USE IDDSI MEASURES



- IDDSI is a *language*, not a *law*
- A *tool*, not a *textbook*
- **Clinical judgement remains the priority!**
- IDDSI can give you a quantitative measure of outcomes and progression:
 - e.g. the Functional Diet Scale^[1]
 - For auditing or research
- Measurements: use them as appropriate



[1] Steele CM et al., *Archives of physical medicine and rehabilitation*. 2018; 99(5):934-44.

“THE SCIENCE IN FRONT OF IDDSI”



Dysphagia
DOI 10.1007/s00455-016-9758-y



ORIGINAL ARTICLE

Development of International Terminology and Definitions for Texture-Modified Foods and Thickened Fluids Used in Dysphagia Management: The IDDSI Framework

Julie A. Y. Cichero^{1,2} · Peter Lam^{1,3,4} · Catriona M. Steele^{1,5,6} · Ben Hanson^{1,7} · Jianshe Chen^{1,8} · Roberto O. Dantas^{1,9} · Janice Duivestein^{1,10,11} · Jun Kayashita^{1,12} · Caroline Lecko^{1,13} · Joseph Murray^{1,14} · Mershen Pillay^{1,15,16} · Luis Riquelme^{1,17,18} · Soenke Stanschus^{1,19}

17,000 downloads in first year

80 PMC citations, 305 Google Scholar citations

“THE SCIENCE IN FRONT OF IDDSI”



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Filters Timeline Sorted by: Best match

43 results

43 articles

IDDSI TESTING FOODS AND DRINKS



Thickened Liquids Using Pureed Foods for Children with Dysphagia: IDDSI and Rheology Measurements.

Brooks L, Liao J, Ford J, Harman S, Breedveld V.
Dysphagia. 2021 May 5. doi: 10.1007/s00455-021-10308-1. Online ahead of print.
PMID: 33954811

The International Dysphagia Diet Standardisation Initiative (IDDSI) flow test was performed for each sample of puree thickened liquids, gum based thickened water, and cornstarch based thickened water. ...

Effect of Formula Type and Preparation on International Dysphagia Diet Standardisation Initiative Thickness Level and Milk Flow Rates From Bottle Teats.

Pados BF, Feaster V.
Am J Speech Lang Pathol. 2021 Jan 27;30(1):260-265. doi: 10.1044/2020_AJSLP-20-00272. Epub 2021 Jan 19.
PMID: 33465317

Method The ready-to-feed and powder formulations of the following products were tested for IDDSI thickness level, using IDDSI guidelines, and for milk flow rate, using established flow testing methods: Similac Advance, Similac For Spit-Up, Enfamil ...

A Comparison of Behavior of Transitional-State Foods Under Varying Oral Conditions.

Barewal R, Shune S, Ball J, Kosty D.
Dysphagia. 2021 Apr;36(2):316-324. doi: 10.1007/s00455-020-10135-w. Epub 2020 May 26.
PMID: 32458146

Benchmark preparation via the International Dysphagia Diet Standardisation Initiative (IDDSI) protocol was also completed. An IDDSI fork pressure test was then performed on all samples. ...These findings support the need for individual testing to explore post-oral ...

IDDSI IMPLEMENTATION



Implementation Strategies for the International Dysphagia Diet Standardisation Initiative (IDDSI), Part I: Quantitative Analysis of IDDSI Performance Among Varied Participants.

Rule DW, Kelchner L, Mulkern A, Couch S, Silbert N, Weiden K.

Am J Speech Lang Pathol. 2020 Aug 4;29(3):1514-1528. doi: 10.1044/2020_AJSLP-19-00012. Epub 2020 Jun 8.

PMID: 32510986

All participants completed a baseline knowledge quiz, 30 min of self-study using the IDDSI.org curriculum, a post self-study knowledge quiz, and a TMD classification task of 21 TMD samples with representation across all IDDSI levels. ...No significant predictive rel...

Creation and Initial Validation of the Caregiver Analysis of Reported Experiences with Swallowing Disorders (CARES) Screening Tool.

Shune SE, Resnick B, Zarit SH, Namasivayam-MacDonald AM.

Am J Speech Lang Pathol. 2020 Nov 12;29(4):2131-2144. doi: 10.1044/2020_AJSLP-20-00148. Epub 2020 Oct 13.

PMID: 33049154

A heterogeneous group of 26 family caregivers of people with dysphagia completed the CARES, along with the Eating Assessment Tool (EAT-10), the International Dysphagia Diet Standardisation Initiative Functional Diet Scale (IDDSI-FDS), and the Zarit Burden Interview (ZBI). I ...

69

ASSESSING NEW PRODUCTS / THERAPIES



Are Medication Swallowing Lubricants Suitable for Use in Dysphagia? Consistency, Viscosity, Texture, and Application of the International Dysphagia Diet Standardization Initiative (IDDSI) Framework.

Majouh MA, Clohero JAY, Manrique YJ, Crino L, Lau ET, Nissen LM, Steadman KJ.

Pharmaceuticals. 2020 Sep 25;12(10):924. doi: 10.3390/pharmaceutics12100924.

PMID: 32998301 Free PMC article.

Four other Gloup products were IDDSI level 3 (liquidised/moderately thick) at room temperature but testing at 4 C or pouring from the container instead of using the pump dispenser resulted in classification as IDDSI level 4. ...Severo was IDDSI level 2. Heyax ...

Validating the textural characteristics of soft fish-based paste through International Dysphagia Diet Standardisation Initiative recommended tests.

Xie Y, Zhao W, Yu W, Lin X, Tao S, Prakash S, Dong X.

J Texture Stud. 2021 Apr;52(2):240-250. doi: 10.1111/jtxs.12578. Epub 2021 Jan 4.

PMID: 33315243

This study investigated the textural characteristics of a soft fish paste produced from steamed grass carp fillet with different the water addition, grinding cycles and ratio of starch with the mixture of steamed fillet and water, following International Dysphagia Diet Standards

The impact of modification techniques on the rheological properties of dysphagia foods and liquids.

de Villiers M, Hanson B, Moodley L, Pillay M.

J Texture Stud. 2020 Feb;51(1):164-168. doi: 10.1111/jtxs.12476. Epub 2019 Sep 1.

PMID: 31397895

The International Dysphagia Diet Standardization Initiative's (IDDSI) standards were used to determine whether the texturally modified SNF is safe for swallowing. ...This study provides new data on how texture modification techniques and the IDDSI framework c ...

70

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71