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The features marked with a star (*) are based entirely on material taken straight from standard research (and other Official and Therefore Always Correct) literature. Many of the other articles are genuine, too, but we don't know which ones.

ANNALS OF IMPROBABLE RESEARCH

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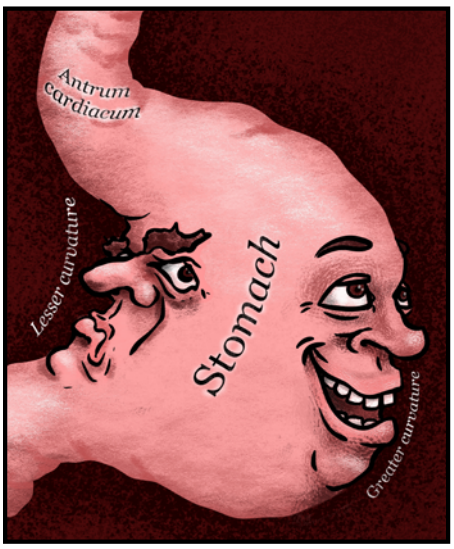
Where There's More

There's always new improbable — it's not what you expect! — stuff on the **Improbable Research blog** at IMPROBABLE.COM



On the Front Cover
Artist S. Gliksman's attempt to depict the Janus-faced nature of the human digestive system.

Some Coming Events

(See IMPROBABLE.COM for details of these and other events.)

September 18, 2025
— The 35th First Annual Ig Nobel Prize Ceremony

September 20, 2025
— Ig Nobel Face-to-Face

November 7-9, 2025
— Falling Walls, Berlin, Germany

November 12, 2025
— Monell Center, Philadelphia, USA

Digestion: Input

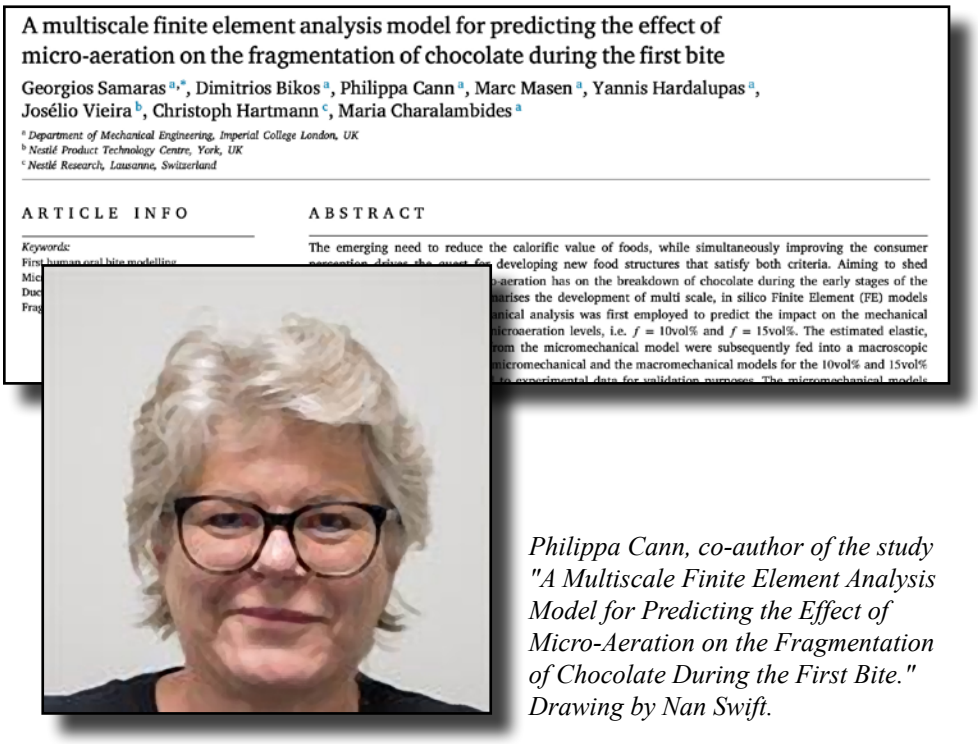
Examinations of what enters into the digestion process

compiled by Aseel Omran-Waed, Improbable Research staff

Fragmentation of Chocolate During the First Bite

"A Multiscale Finite Element Analysis Model for Predicting the Effect of Micro-Aeration on the Fragmentation of Chocolate During the First Bite," Georgios Samaras, Dimitrios Bikos, Philippa Cann, Marc Masen, Yannis Hardalupas, Josélio Vieira, Christoph Hartmann, and Maria Charalambides, *European Journal of Mechanics-A/Solids*, vol. 104, no. 1, March 2024, article 105221. The authors, at Imperial College London, UK; Nestlé Product Technology Centre, UK; and Nestlé Research, Switzerland, report:

> The micromechanical models are compared to data from literature on mechanical testing of the same two chocolate materials whereas the first-bite macromechanical model was compared to in vitro experimental data obtained in this study using a 3D-printed molar teeth test rig mounted to a mechanical tester. Finally, the particle size distribution of the fragmented chocolate during the first bite was estimated from the in silico model and compared to in vivo literature data on the same chocolate materials and in vitro experimental data from this work. All comparisons between the in silico models and the in vitro/in vivo data led to good agreement.



A multiscale finite element analysis model for predicting the effect of micro-aeration on the fragmentation of chocolate during the first bite

Georgios Samaras [a,*], Dimitrios Bikos [a], Philippa Cann [a], Marc Masen [a], Yannis Hardalupas [a], Josélio Vieira [b], Christoph Hartmann [c], Maria Charalambides [a]

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ARTICLE INFO

Keywords:

ABSTRACT

The emerging need to reduce the calorific value of foods, while simultaneously improving the consumer

Philippa Cann, co-author of the study "A Multiscale Finite Element Analysis Model for Predicting the Effect of Micro-Aeration on the Fragmentation of Chocolate During the First Bite." Drawing by Nan Swift.

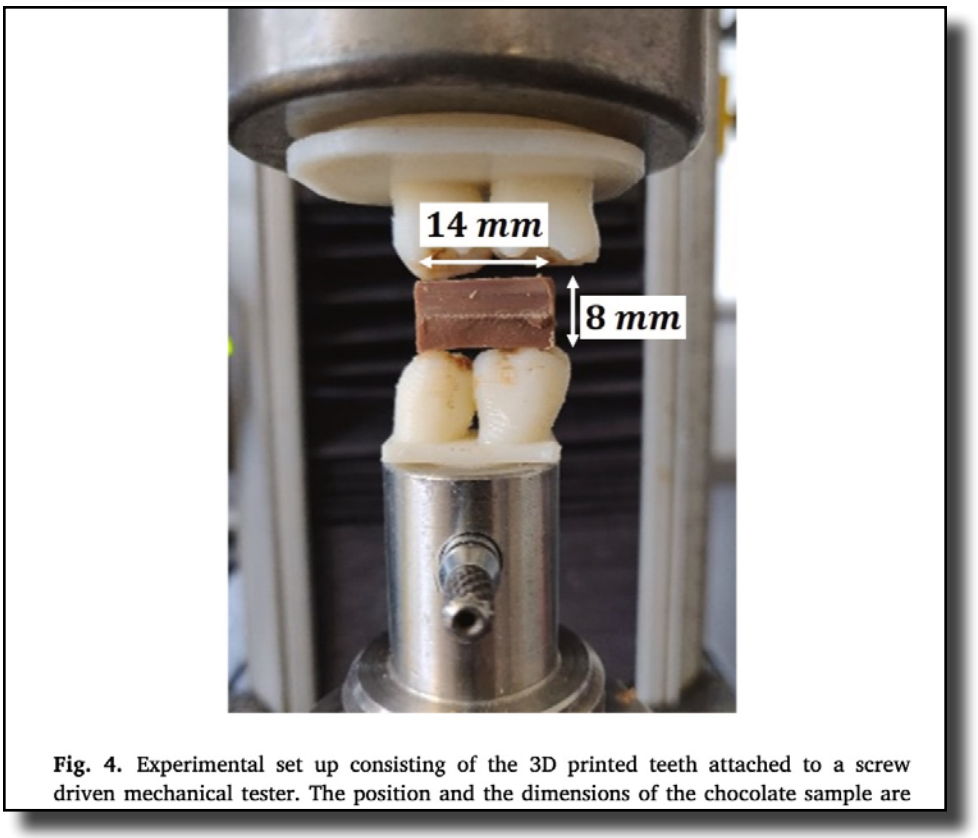


Fig. 4. Experimental set up consisting of the 3D printed teeth attached to a screw driven mechanical tester. The position and the dimensions of the chocolate sample are

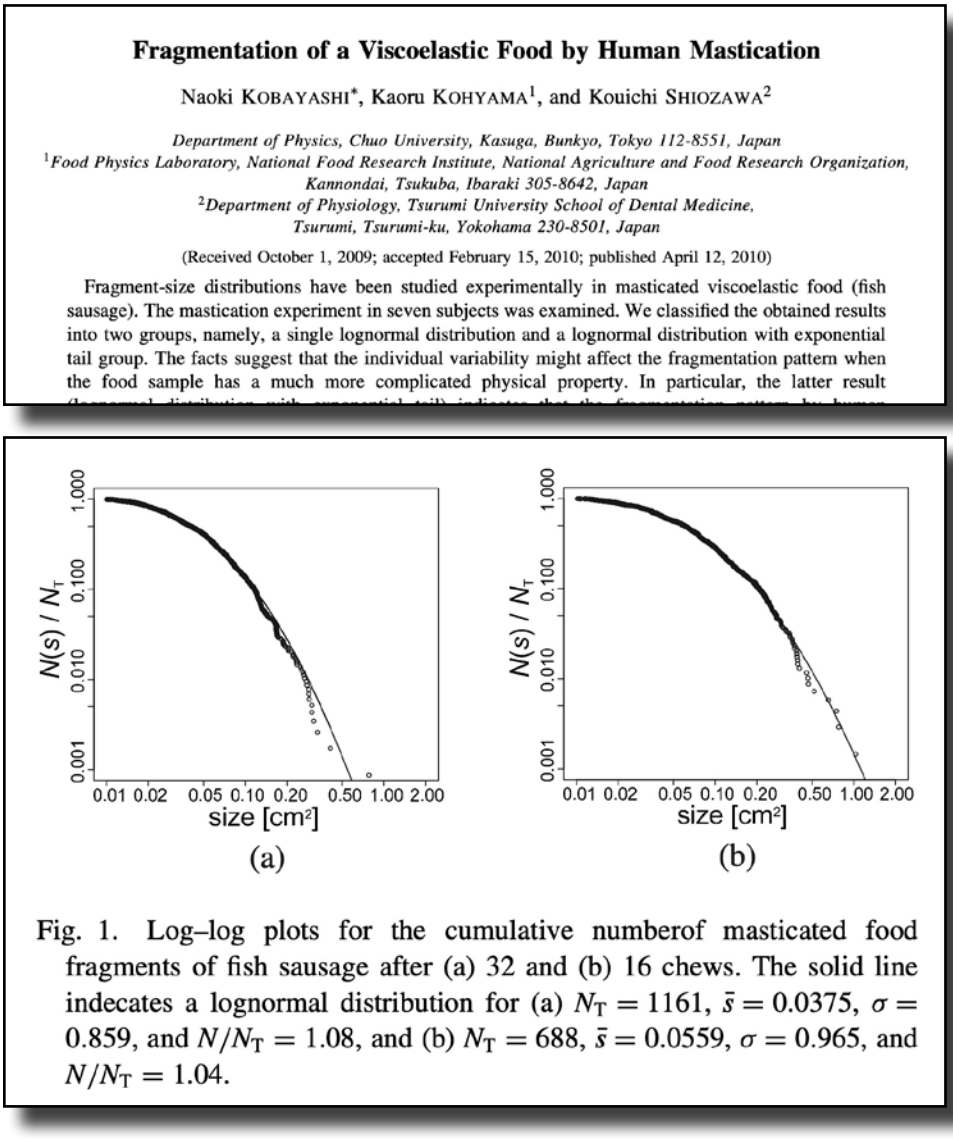
Detail from the study "A Multiscale Finite Element Analysis Model for Predicting the Effect of Micro-Aeration on the Fragmentation of Chocolate During the First Bite."

Stochastic Mastication of Viscoelastic Fish Sausage

"Fragmentation of a Viscoelastic Food by Human Mastication," Naoki Kobayashi, Kaoru Kohyama, and Kouichi Shiozawa, *Journal of the Physical Society of Japan*, vol. 79, no. 4, 2010, article 044801. *(Thanks to Claire Marrache for bringing this to our attention.)* The authors, at Chuo University, National Agriculture and Food Research Organization, and Tsurumi University School of Dental Medicine, Japan, report:

> Fragment-size distributions have been studied experimentally in masticated viscoelastic food (fish sausage). The mastication experiment in seven subjects was examined....

First, each subject masticated the test food until swallowing as usual to count the number of chewing cycles until swallowing. Next, we calculated the individual number of chewing cycles until the halfway of the mastication. To collect the food bolus at the halfway of the mastication and just before swallowing, subjects were asked to masticate the test food until individually prescribed number of chewing cycles, and they spat the bolus into a beaker. The collection of food bolus was performed two times per subject and each condition. In order to expectorate entirely the subject rinsed their mouth with water. The food fragments and water were carefully stirred in a beaker with a grass rod and pass through a sieve with a mesh size of 0.5 mm. After fine fragments were washed through the sieve with running water, the fragments on the sieve were spread evenly on the transparent acrylic board (300 mm × 300 mm). Then, we made a copy of this board using copy machine (DocuCentra-II, FUJI XEROX, JAPAN) without cover and stored the copy on a personal computer at a suitable resolution (about 0.13 mm/pixel).



Fragmentation of a Viscoelastic Food by Human Mastication

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(Received October 1, 2009; accepted February 15, 2010; published April 12, 2010)

Fragment-size distributions have been studied experimentally in masticated viscoelastic food (fish sausage). The mastication experiment in seven subjects was examined. We classified the obtained results into two groups, namely, a single lognormal distribution and a lognormal distribution with exponential tail group. The facts suggest that the individual variability might affect the fragmentation pattern when the food sample has a much more complicated physical property. In particular, the latter result

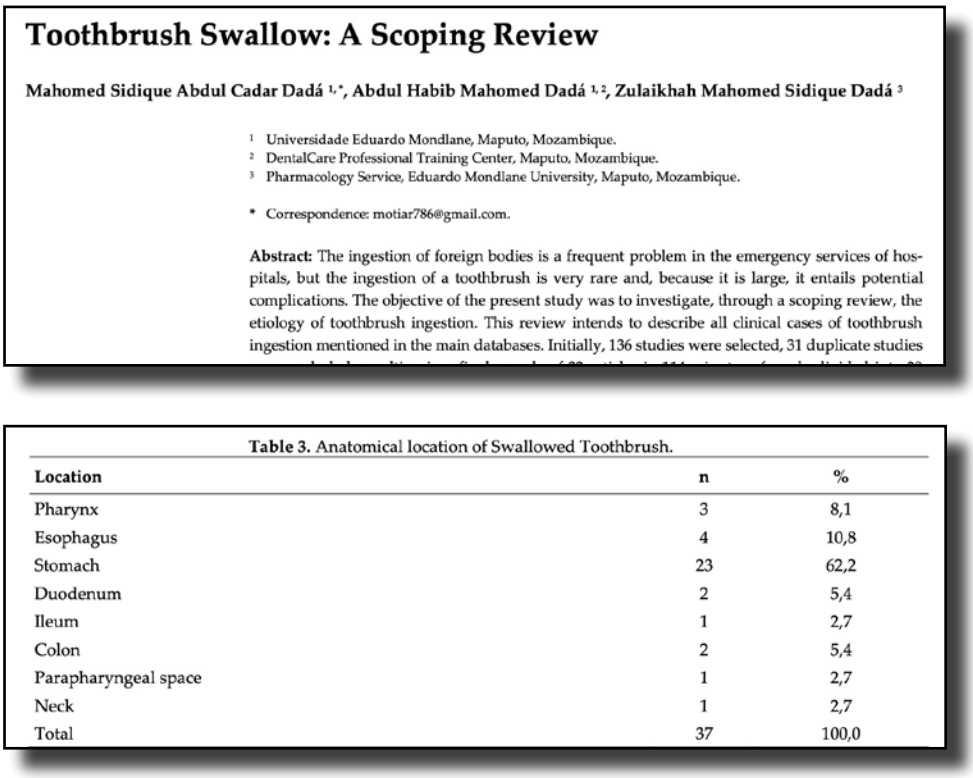
Fig. 1. Log–log plots for the cumulative numberof masticated food fragments of fish sausage after (a) 32 and (b) 16 chews. The solid line indecates a lognormal distribution for (a) $N_T = 1161$, $\bar{s} = 0.0375$, $\sigma = 0.859$, and $N/N_T = 1.08$, and (b) $N_T = 688$, $\bar{s} = 0.0559$, $\sigma = 0.965$, and $N/N_T = 1.04$.

Detail from the study "Fragmentation of a Viscoelastic Food by Human Mastication."

Who Put the Toothbrushes in the Digestive Tract

"Toothbrush Swallow: A Scoping Review," Mahomed Sidique Abdul Cadar Dadá, Abdul Habib Mahomed Dadá, and Zulaikhah Mahomed Sidique Dadá, *Brazilian Journal of Clinical Medicine and Review*, vol. 2, no. 2, 2024, pp. 42-53. The authors, at Universidade Eduardo Mondlane, DentalCare Professional Training Center, and Eduardo Mondlane University, Mozambique, report:

> [T]he ingestion of a toothbrush is very rare and, because it is large, it entails potential complications. The objective of the present study was to investigate, through a scoping review, the etiology of toothbrush ingestion. This review intends to describe all clinical cases of toothbrush ingestion mentioned in the main databases. Initially... toothbrush swallow is rare. In this study it was found that most cases of toothbrush ingestion were intentional (bulimia, induction of vomiting and mental disorder) and the toothbrushes that appear in the gastrointestinal tract are placed by the patients accidentally or intentionally and rarely by someone else.



Toothbrush Swallow: A Scoping Review

Mahomed Sidique Abdul Cadar Dadá [1,*], Abdul Habib Mahomed Dadá [1,2], Zulaikhah Mahomed Sidique Dadá [3]

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[3] Pharmacology Service, Eduardo Mondlane University, Maputo, Mozambique.

* Correspondence: motiar786@gmail.com.

Abstract: The ingestion of foreign bodies is a frequent problem in the emergency services of hospitals, but the ingestion of a toothbrush is very rare and, because it is large, it entails potential complications. The objective of the present study was to investigate, through a scoping review, the etiology of toothbrush ingestion. This review intends to describe all clinical cases of toothbrush ingestion mentioned in the main databases. Initially, 136 studies were selected, 31 duplicate studies

Table 3. Anatomical location of Swallowed Toothbrush.

Location	n	%
Pharynx	3	8,1
Esophagus	4	10,8
Stomach	23	62,2
Duodenum	2	5,4
Ileum	1	2,7
Colon	2	5,4
Parapharyngeal space	1	2,7
Neck	1	2,7
Total	37	100,0

Detail from the study "Toothbrush Swallow: A Scoping Review."