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How does saliva affect bread oral processing?

From artificially-simulated dry mouth to hypersalivation

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Introduction

Developing novel foods tailored for specific groups requires further understanding of the intricacies involved in food oral processing, particularly the crucial role played by saliva. Saliva facilitates food oral processing, bolus formation, swallowing, and sensory perception, in addition to contributing to oral health and phonation. Ageing, health affections and polymedication are among many causes of altering salivary

production, modifying the food impregnation ratio, and in turn altering the bolus characteristics, swallowing, and quite possibly digestion.

Aim

In this *in vitro* work, using the AM2 masticator^[1], we investigated the effect of salivary fluid characteristics, i.e., composition, quantity (from absence to excess), temperature, and enzymatic action on the physical characteristics of boluses of Traditional French baguette.

Materials & Methods

Variables controlled:

- Salivary fluid temperature (20 and 37°C)
- Salivary fluid quantity (0, 2, and 4 mL)
- Type of the oral lubricant (Water, BSF*, and AS**)
- Human salivary α -amylase (with and without deactivation)



Variables measured:

- Particle size distribution (PSD)
- Bolus mass
- Salivary fluid content

* **Basic Salivary Fluid** containing minerals and mucin, and showing similar shear viscosity to human saliva [2].

** **Artificial Saliva:** BSF containing 92 U/mL α -amylase from human saliva [2,3].

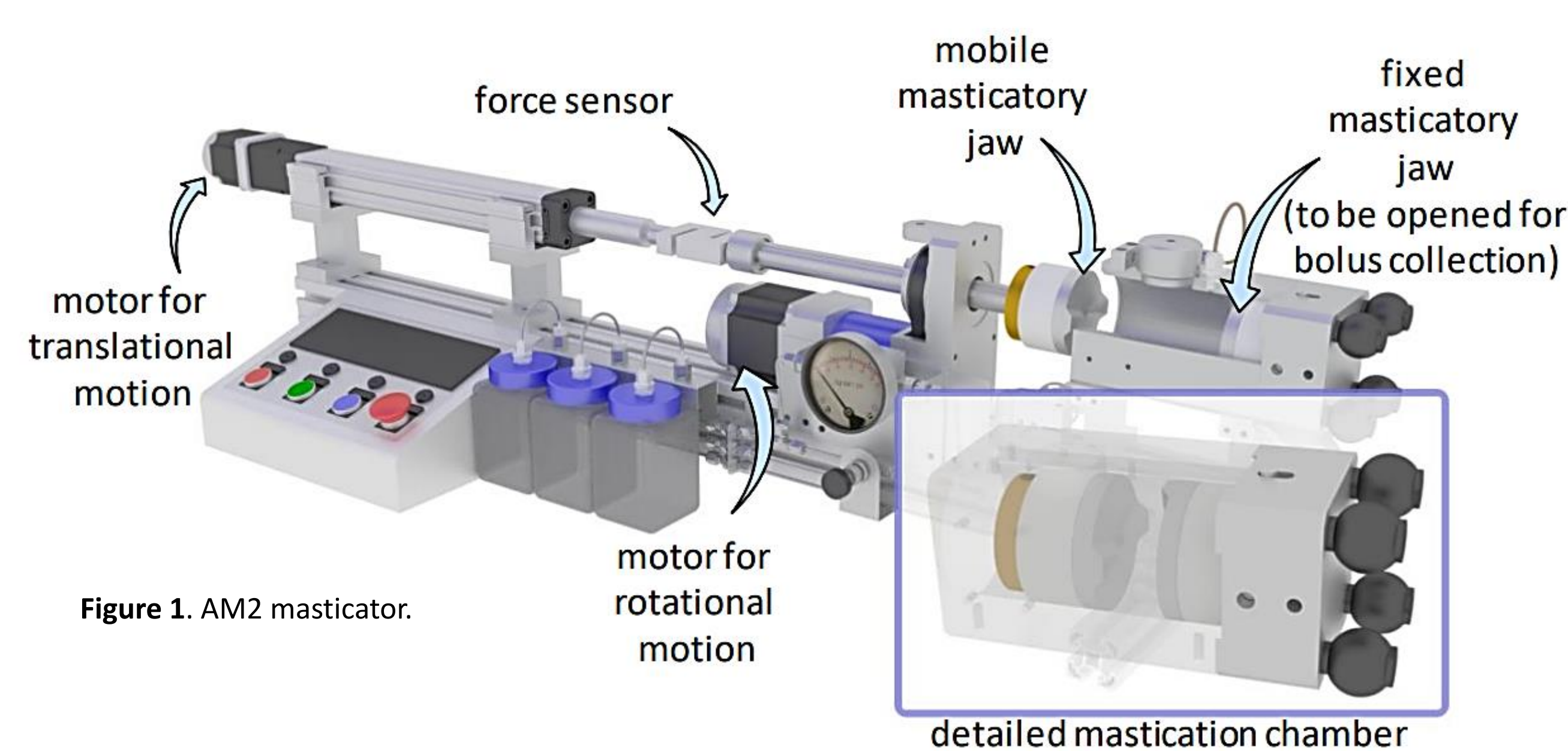


Figure 1. AM2 masticator.

AM2 Validation & Results

Validation

The AM2 was programmed using *in vivo* data of 10 young and healthy subjects (32±6 years): 25 masticatory cycles in a mean sequence duration of 17 secs.

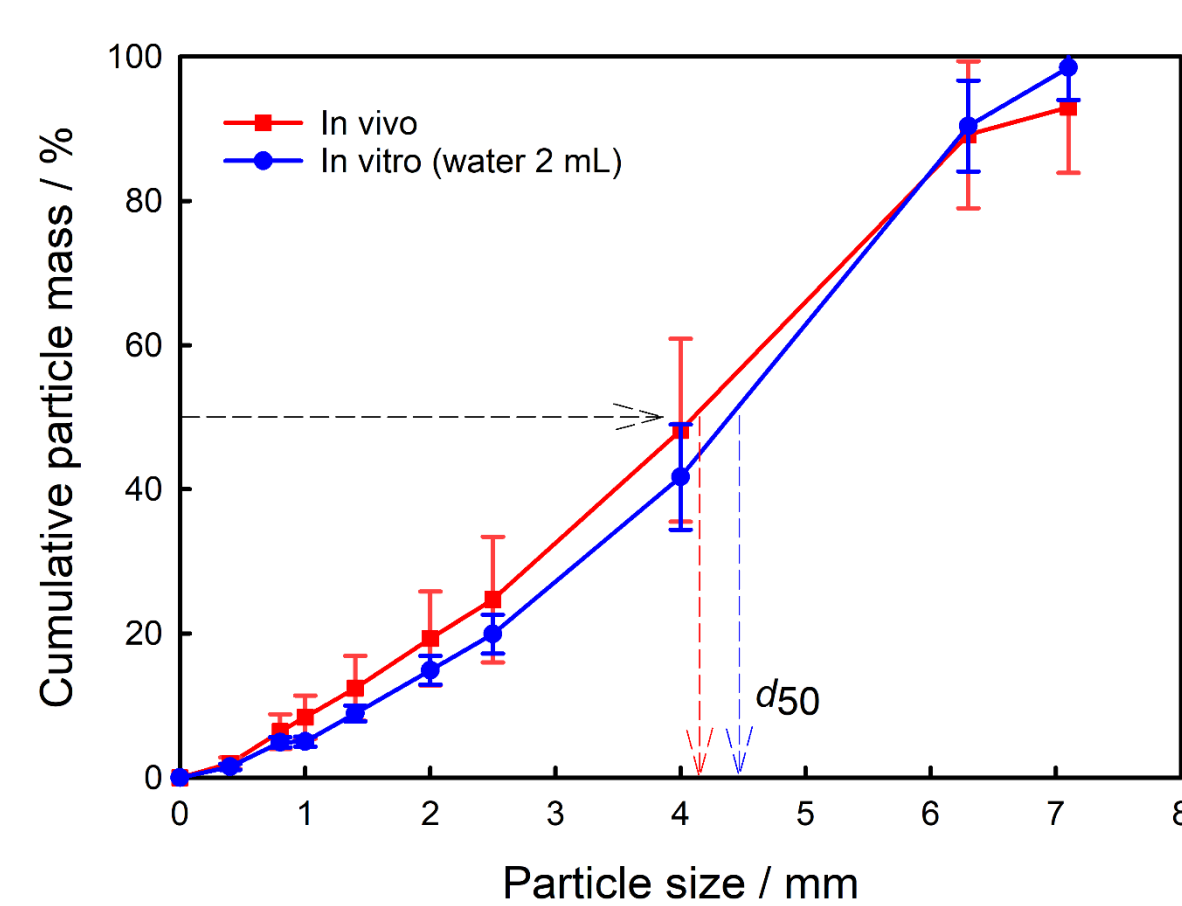


Figure 2. AM2 validation: *in vivo* vs *in vitro* data.

Results

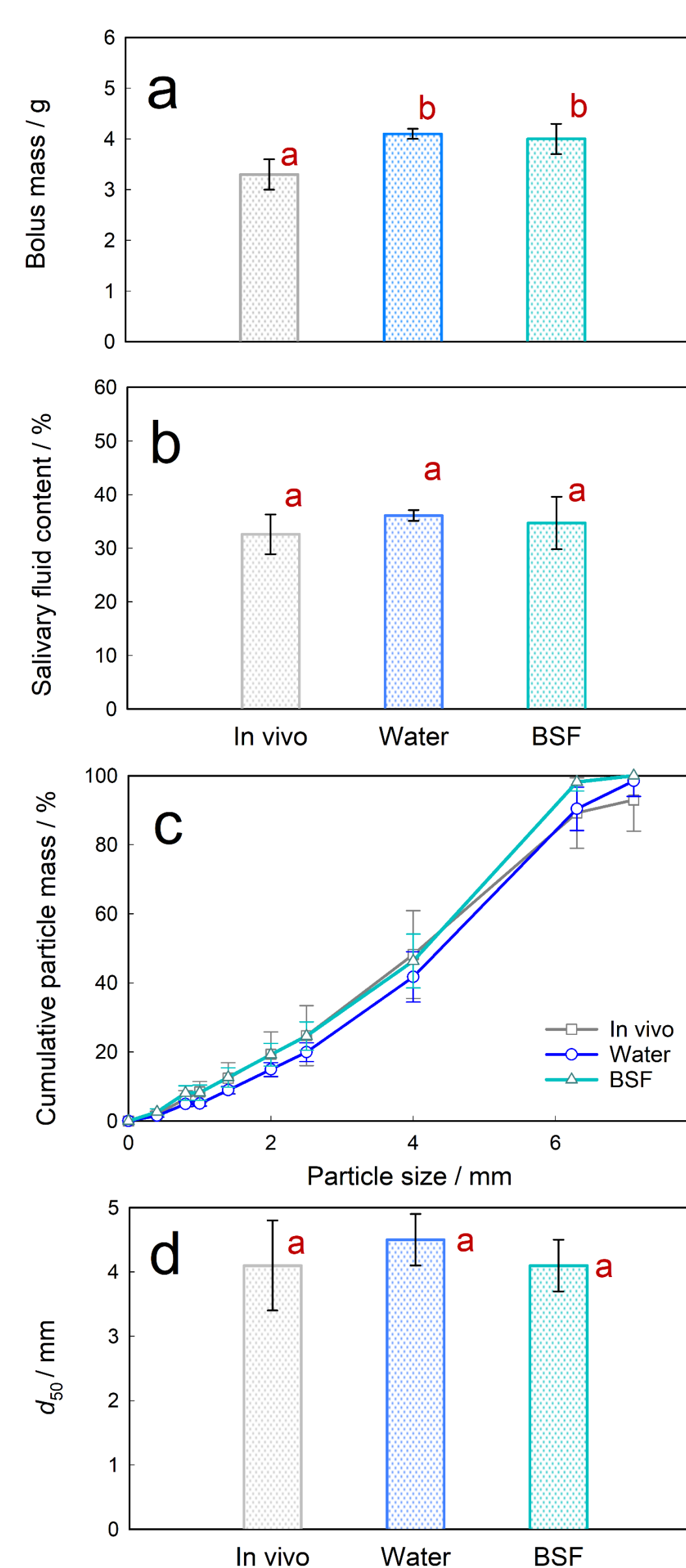


Figure 3. Salivary fluids type.

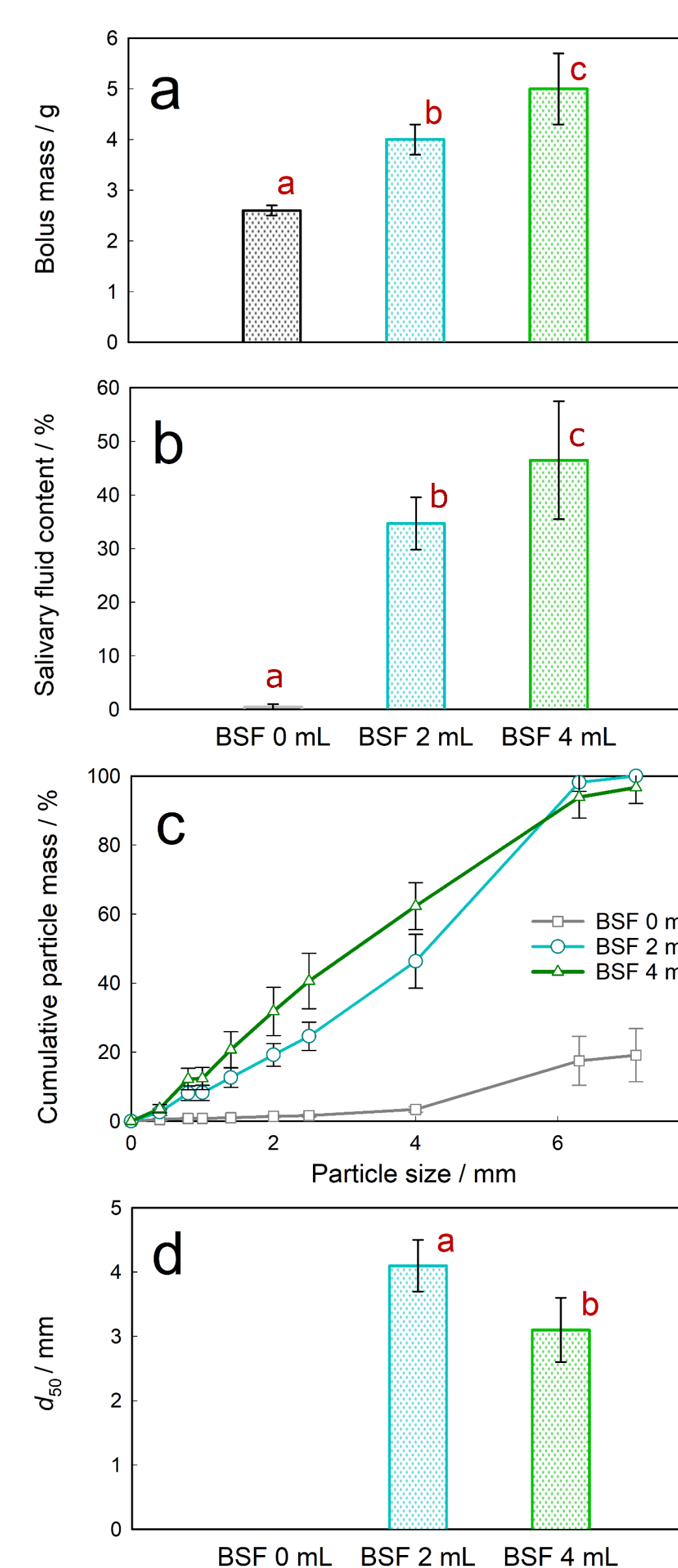


Figure 4. Salivary fluid quantify.

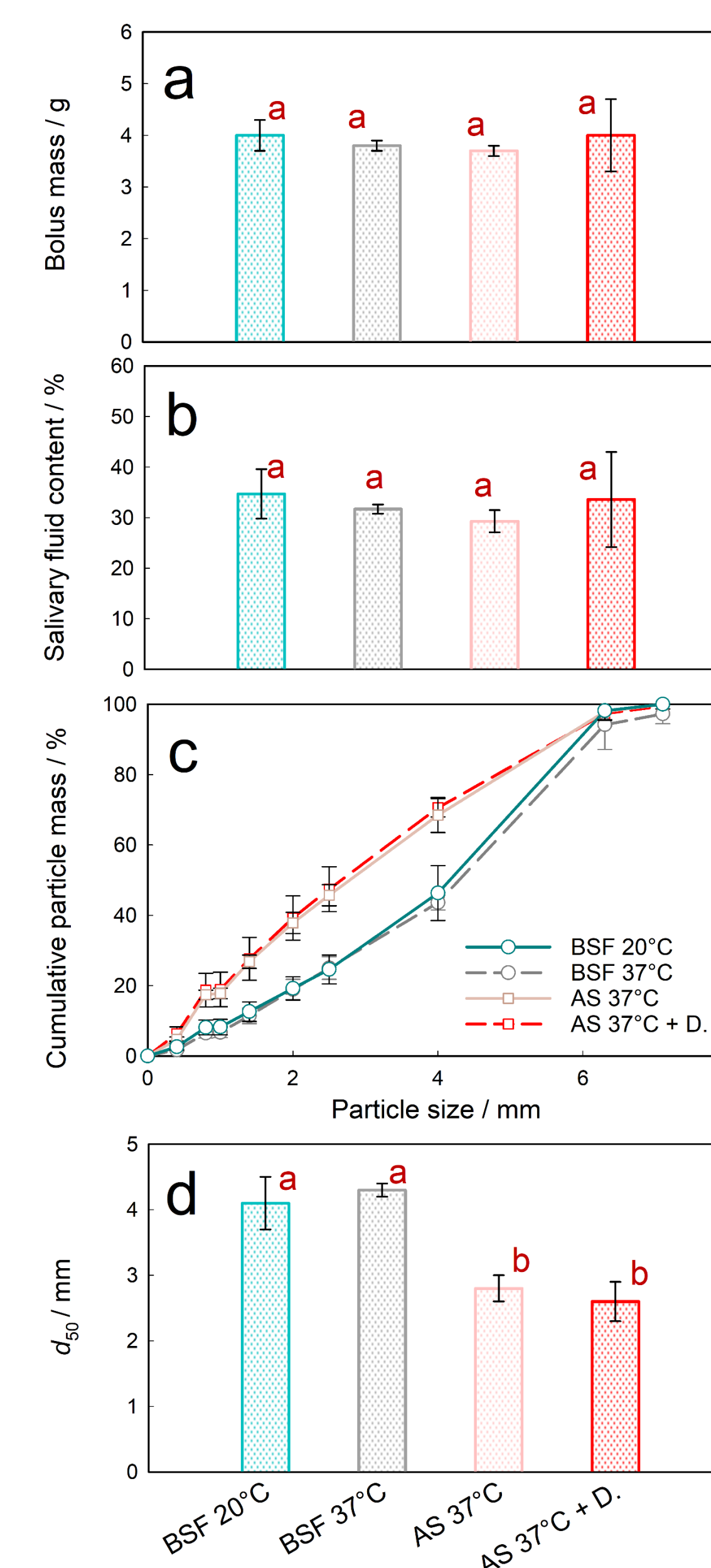


Figure 5. Salivary fluid temperature and enzymatic action.

KEY RESULTS:

- Saliva temperature did not affect PSD, bolus mass or fluid content.
- Human salivary α -amylase favoured particle size reduction.
- The absence of saliva led to deficient oral processing (~80% of particles >7.1 mm).
- An excess of saliva led to boluses constituted by smaller particles (d_{50} 3.1 mm) and a higher fluid content (>10% increase).

Final remark

Beyond the correlation between bolus hydration and food properties such as hardness and moisture content, our findings indicate that the **saliva quantity in mouth and its enzymatic activity significantly affect both the particle size distribution and fluid content of bread boluses**, ultimately determining the physical properties of the bolus. Moreover, this research stresses the **crucial role that food moisture could have in developing novel food textures tailored to individuals with compromised oral functionality** (e.g., mastication, saliva production) while ensuring the formation of a cohesive food bolus that can be safely swallowed.

[1] Peyron et al., 2019. Food Hydrocolloids, 97, 105229.

[2] Roger-Leroi et al., 2012. Tropical Dental Journal, 35(138), 5-14.

[3] Mandel et al., 2010. PLOS ONE, 5(10), e13352.