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Sugary and Acidic Products on Saliva: Tribological and Protein Adsorption Perspective

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Objectives The purpose of this study was to compare the lubrication, adsorption behaviour, and total protein concentration (TPC) of whole mouth saliva (WMS) after the consumption of fruit juice.
Methods Apple juice (J) with pH 3.55 and 11.1gm/100ml sugar content was selected as the erosive product; water (W) was the control. Thirty-two healthy participants contributed saliva in two visits across five time points: Unstimulated saliva (US), stimulated saliva after 1 minute (SJ1 or SW1), and stimulated saliva after 10 minutes (SJ10 or SW10). Three methods were utilized: tribology with polydimethylsiloxane (PDMS) pairs for lubrication analysis, ex-vivo preparation of juice-saliva on quartz crystal microbalance with dissipation (QCM-D) to assess adsorption, and total protein concentration (TPC) quantification via Bicinchoninic acid (BCA) assay on randomly selected saliva samples (n=20 each).
Results Unstimulated saliva (US) initially had the lowest friction coefficient (μ) of 0.011(0.007), indicating enhanced lubrication. Stimulation with juice [SJ1: 0.045(0.024)] and water [SW1: 0.112 (0.048)] significantly reduced lubrication after one minute ($p<0.05$). After 10 minutes, SJ10 maintained higher frictional properties compared to SW10, indicating prolonged increase in saliva friction. Significant differences were observed within water and juice groups for immediate versus 10-minute intervention ($p<0.05$). Exposure to fruit juice led to significant reduction in hydrated mass of preabsorbed salivary films (US-Juice) from 23.7± 2.0 to 15.7± 0.3, restored after rinsing with buffer (US-Juice-buffer). TPC of US [1.67 (0.38) mg/ml] was significantly higher than SW1 [1.11(0.92)mg/ml] and SJ10 [1.084 (0.73) mg/ml] ($p<0.05$). Significant differences were observed between juice-stimulated saliva after one minute (SJ1) and 10 minutes (SJ10), similar to tribology results.
Conclusions Fruit juice consumption reduced lubrication, caused dehydration and mass loss, and altered TPC compared to unstimulated saliva. Differences between immediate and 10-minute interventions highlight saliva's dynamic nature, potentially impacting oral acid buffering and enamel protection, especially considering consumption duration.