Sucrose and Fructose in Spot Urine as a Biomarker of Total Sugars Intake – Findings From a Controlled Feeding Study

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Objectives: To investigate the utility of sucrose and fructose measured in spot urine (uSF) as a measure of 24-h urinary sucrose and fructose (24uSF) and a biomarker of total sugars (TS) intake.

Methods: A hundred participants, 18–70 years of age, recruited from the Phoenix Metropolitan Area completed a 15-d controlled feeding study, which simulated their usual dietary behavior. Participants collected eight nonconsecutive 24-h urines; for two of the urine collections, each spot urine void was collected in a separate container. In the analysis, we considered four voids out of all voids collected for the day [AM void – 1st void after a meal or between 8:30 am to 12:30 pm; PM void - 1st void after a meal and between 12:31 pm to 5:30 pm; EVE void - 1st void after a meal and between 5:31 pm to 12:00 am; and Next-day (ND) void - 1st next day morning void and between 4:00 am to 12:00 pm]. We investigated the performance of uSF measured in one void, and uSF combined from two and three voids as a measure of 1) 24uSF and 2) TS intake.

Results: Among the four selected voids, averaged over two collection days, uSF measured in the EVE void correlated best with 24uSF [partial r (adjusted for urinary creatinine) = 0.69]. For uSF biomarker combined from two voids, PM/EVE void produced the strongest correlation with 24uSF (r = 0.75). The correlation only marginally improved, when adding a 3rd void (PM/EVE/ND: r = 0.78). Based on these findings, we developed prediction equations for log(24uSF) based on log(uSF) measured in EVE, PM/EVE or PM/EVE/ND voids, adjusted for gender, log(age), BMI and log(creatinine). The R^2 from the linear mixed model relating predicted 24uSF based on EVE, PM/EVE or PM/EVE/ND voids with observed TS, age and gender was 0.30, 0.46 and 0.48, respectively. Biomarker-estimated TS intake based on log(24uSF) predicted from PM/EVE voids had moderate model-based estimates of correlation with 'usual' TS intake (for uSF measured in PM/EVE voids from 1 day, r = 0.34; from 2 days, r = 0.45; and from 4 days, r = 0.52).

Conclusions: Our findings suggest that uSF measured in PM/EVE voids performs well as a measure of 24uSF, and may be used to generate biomarker-based TS intake estimate when collecting of 24-urine is not feasible. Collecting PM and EVE voids over at least 2 nonconsecutive days rather than one day will produce less biased results.