Evaluation of Alcohol Markers in Urine and Oral Fluid after Kombucha Consumption

Sun Yi Li*[1], Christina R. Smith[1], Sarah H. Bartock[2], F. Leland McClure[3], Les E. Edinboro[2], Madeleine J. Gates[1]

[1] Department of Forensic Science, Sam Houston State University, Huntsville, TX, USA

[2] Quest Diagnostics Nichols Institute, Chantilly, VA, USA

[3] Drug Testing Consultations, LLC

Quest Diagnostics™

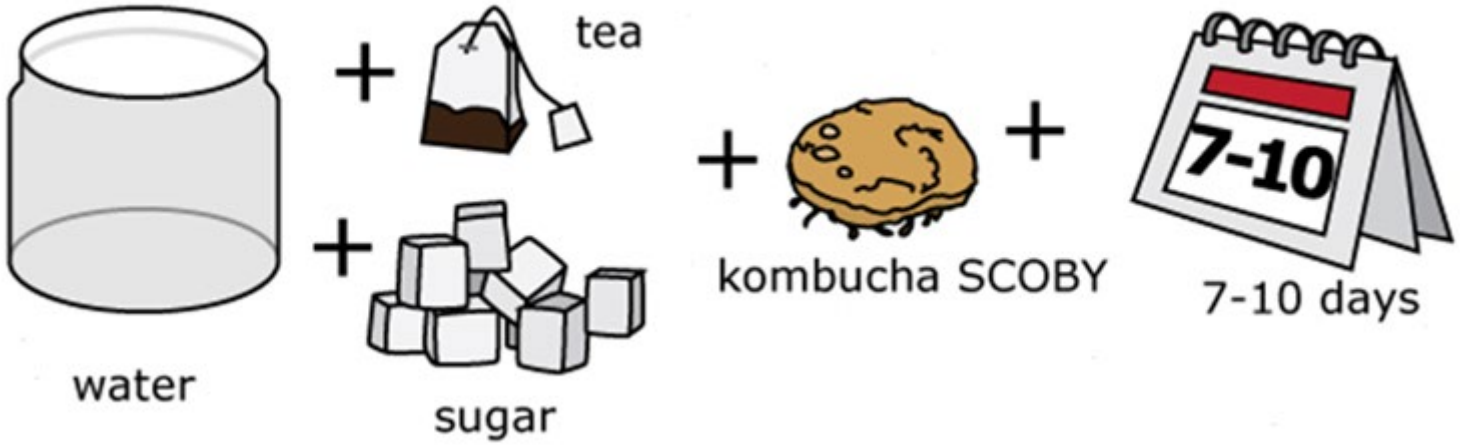
Sam Houston State University

Disclaimer

- The authors have no conflict of interest to disclose.

Kombucha

- Sweet and sour drink brewed from tea, sugar, bacteria/yeast



- Natural/ artificial flavorings
  - Juice, spices, extracts

Image obtained from: https://www.womenfitnessmag.com/wp-content/uploads/2019/01/How-to-make-your-own-Kombucha.jpg

Kombucha

- Potential health benefits
  - Probiotic supplement
  - Immune system booster
  - Antioxidant
- Home-brewing → commercially available

https://www.foodbeverageinsider.com/sites/foodbeverageinsider.com/files/styles/article_featured_retina/public/Crafting%20commercial%20kombucha%20to%20meet%20consumer%20needs1540x800.jpg?itok=IL5UtDbG
https://qtxasset.com/worldteanews/uploads/2018/01/WTN180102_WonderDrinkKombucha_480px.jpg

Kombucha

- Fermentation process naturally produces ethanol
  - “Hard” Kombucha
  - Regular Kombucha labeled as “non-alcoholic”

- US FDA Labeling Regulations (CPG Sec 510.400,2015)
  - Beverages labeled as “non-alcoholic”: ABV < 0.5%

- Liu & Chan et al. (2019)
  - ABV level in “non-alcoholic” Kombucha drinks
  - 1.25 – 2.03%

Forensic Relevance

- DUI/workplace drug testing
  - Unintentional intoxication after consumption
  - “Kombucha” excuse

Purpose of Study

- Determine if alcohol markers, ethyl glucuronide (EtG) and ethyl sulfate (EtS) are present in urine and oral fluid after Kombucha consumption

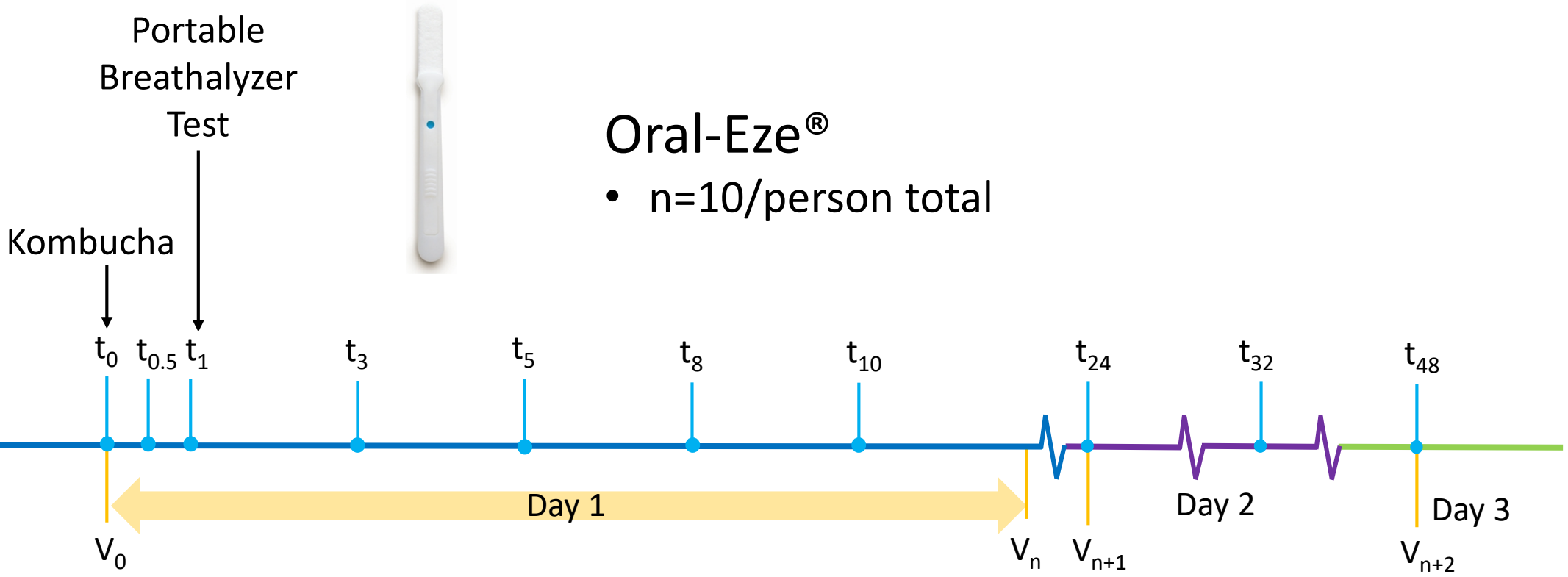
Study Design

- Approved by SHSU IRB: #IRB-2019-249
  - Written informed consent

- 12 participants (N= 6 Males, 6 Females)
  - Age: 22-27

- Consumed one 16 oz. raw organic Kombucha within 20 min
  - Blueberry ginger (n=6, n=3/gender) or
  - Raspberry lemon ginger (n=6, n=3/gender)
  - Labeled “< 0.5% ABV”

Specimen Collection



Oral-Eze®

- n=10/person total

Urine

- All voids on Day 1
- First void on Day 2 & 3

Sample Analysis

Matrix	Analysis	Cut off (ng/mL)
Oral Fluid	Immunoassay: EtS	25
Urine	Immunoassay: EtG	500
	LC-MS/MS: EtG,EtS	500, 100

- Positive sample: EtS w/ or w/o EtG
- Kombucha ABV determined by headspace GC

Results and Discussion

- Kombucha ABV: 0.6 – 1.0%
  - Blueberry Ginger > Raspberry Lemon Ginger

- All oral fluid specimens were negative for alcohol markers at all timepoints

- All breathalyzer tests were 0.000 within 1 h after drinking

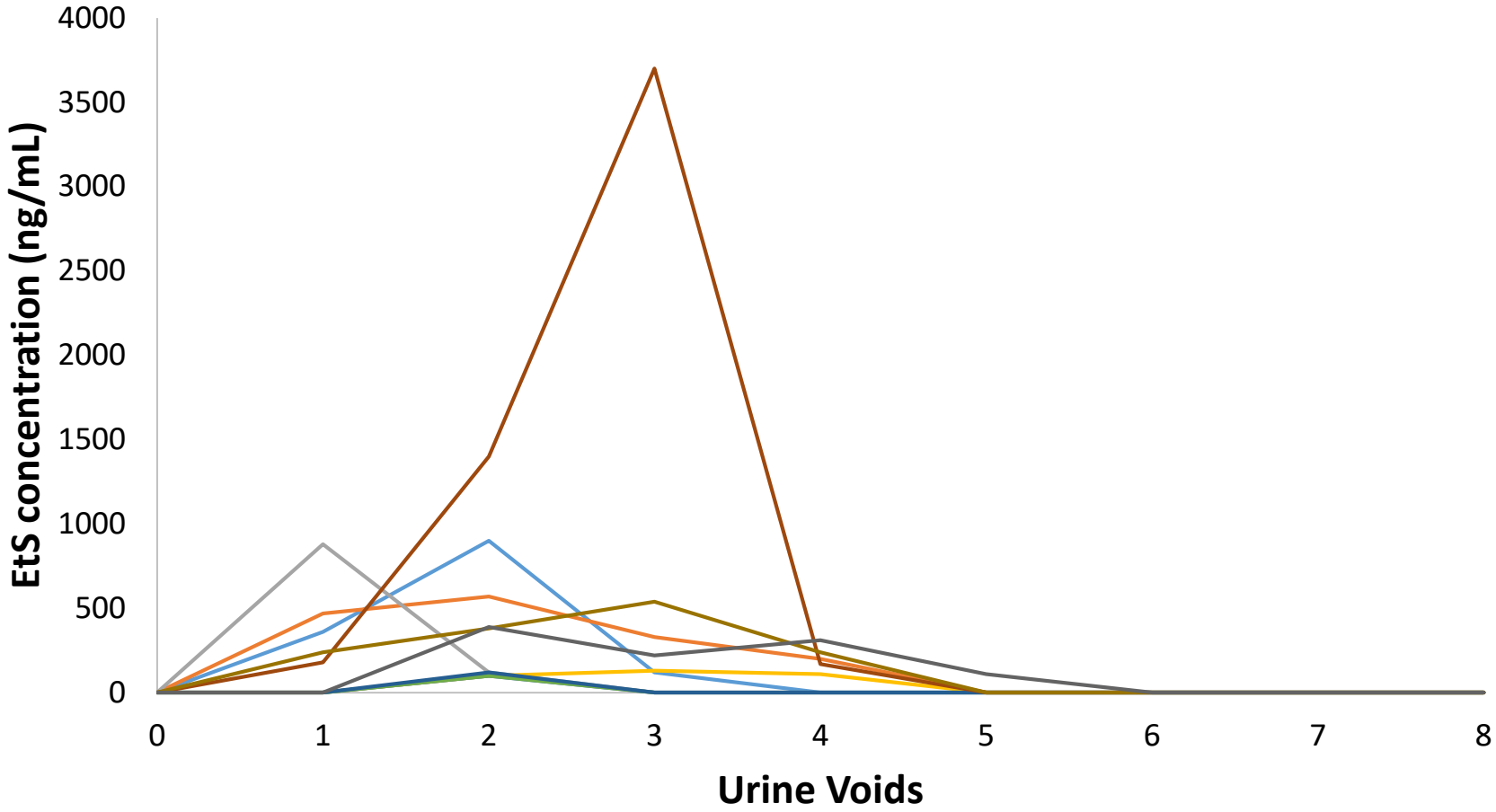
Results and Discussion

- Positive urine specimen detected by LC-MS/MS:

Voids	Positive Counts	Positive %
0	0	0
1st	5	41.7
2nd	10	83.3
3rd	6	50.0
4th	5	41.7
5th	1	8.3
Day 2	0	0
Day 3	0	0

Results and Discussion

- Urine specimen
  - EtS: 462 (100 – 3700) ng/mL; EtG: 1010 (530 – 2200) ng/mL
  - Of 27 positive samples, 16 were EtS only and 11 were EtS & EtG



Results and Discussion

- Performance of immunoassay vs LC-MS/MS confirm (N=105)

<u>Confirm w/ EtG>500</u>

- True Positive: 10
- True Negative: 94
- False Positive: 0
- False Negative: 1

- Sensitivity: 90.9%
- Specificity: 100.0%

<u>Confirm w/ EtS>100</u>

- True Positive: 10
- True Negative: 78
- False Positive: 0
- False Negative: 17

- Sensitivity: 37.0%
- Specificity: 100.0%

Conclusions

- No alcohol markers were detected in oral fluid
- No alcohol was detected in breath
- EtS and EtG detected above cutoff in urine specimen for 10/12 participants in Day 1
  - Negative on Day 2 & 3
- Kombucha consumption could lead to positive detection of alcohol markers in urine specimen

References

- U.S. Food & Drug Administration. (2015). CPG Sec. 510.400. Retrieved from https://www.fda.gov/regulatory-information/search-fda-guidance-documents/cpg-sec-510400-dealcoholized-wine-and-malt-beverages-labeling -2019-249
- Liu, Y., Chan, M., Blake, E., Sy, H., & Brown, P. N. (2019). Determination of Ethanol Content in Kombucha Products by Gas Chromatography with Flame Ionization Detection: A Multilaboratory Study. *Journal of AOAC International*, (3), 878. Retrieved from http://search.ebscohost.com.ezproxy.shsu.edu/login...

Questions

sxl062@shsu.edu