Correlation of the Alcohol Biomarker Ethyl Glucuronide in Fingernails and Hair to Reported Alcohol Consumed

M. Jones, J. Jones, D. Lewis, C. Plate[1], M. Fendrich, L. Berger, D. Fuhrmann[2]

[1]United States Drug Testing Laboratories, Des Plaines, IL 60018

[2]University of Wisconsin-Milwaukee, Milwaukee, WI 53201

ABSTRACT

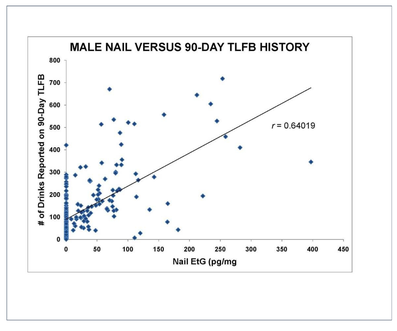
CORRELATION OF THE ALCOHOL BIOMARKER ETHYL GLUCURONIDE IN FINGERNAILS AND HAIR TO REPORTED ALCOHOL CONSUMED. M. Jones, J. Jones, D. Lewis, C. Plate, M. Fendrich, L. Berger, D. Fuhrmann. United States Drug Testing Laboratories, Inc., Des Plaines, IL 60018.

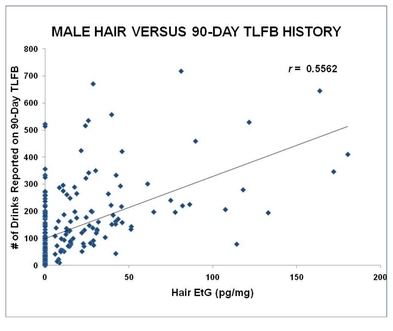
The goal of this study was to determine if a relationship existed between the reported number of drinks consumed over a 90 day period and the measured concentration of the direct alcohol biomarker ethyl glucuronide (EtG) in the fingernails and hair of a college-aged population. This IRB-approved study was conducted by enrolling 606 consented college students from the University of Wisconsin-Milwaukee, determining the number of drinks reported over a 90 day period using the time line followback (TLFB) interview instrument, and collecting fingernail clippings and head hair from each study participant. Biological specimens were sent to USDTL to determine EtG levels. EtG was analyzed by liquid chromatography combined with tandem mass spectrometry. One method of data analysis utilized was determining the Pearson correlation coefficient between each individual's fingernails and hair EtG levels and the number of drinks that the individual reported to have consumed in the previous 90 days to providing the nail and hair samples. For 271 females and 180 males enrolled in this study the Pearson correlation coefficient for EtG in fingernails and number of drinks reported was 0.5153 ($p<.0001$) and 0.6376 ($p<.0001$), respectively. This indicates a large positive correlation between the amount of EtG present in the fingernails and the reported number of drinks consumed. For 178 males the Pearson correlation coefficient for EtG in hair and number of drinks reported was 0.5548 ($p<.0001$), again indicating a large positive correlation between the number of drinks reported consumed and the amount of EtG present in the hair. For 276 females the Pearson correlation coefficient for EtG in hair and number of drinks reported was 0.2752 ($p<.0001$), indicating only a small positive correlation between the number of drinks reported consumed and the EtG present in the hair. Thus, for EtG in hair, there is a gender bias. These findings demonstrate that the levels of the direct alcohol biomarker EtG in fingernails and hair have significant correlations with the number of drinks reported consumed. These findings further demonstrate that fingernails are the preferred specimen for EtG analysis, as they lack the gender bias seen with hair.

THE STUDY

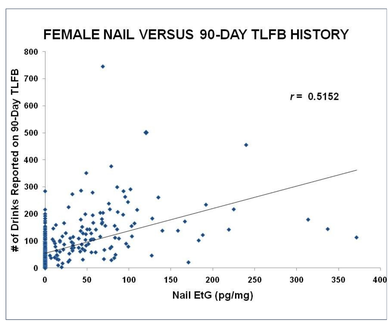
- Enrolled 606 students at the University of Wisconsin-Milwaukee with signed consent forms
- Obtained a Time Line Followback Interview (drinking history for past 90 days) for each consented student
- Obtained AUDIT (Alcohol Use Disorders Identification Test; distinguishes hazardous vs. non-hazardous drinking)
- Obtained a Mini International Neuropsychiatric Interview
- Obtained a Family Tree Questionnaire
- Obtained a Marlowe-Crowne Social Desirability Scale
- Collected nails and hair samples from each consented student

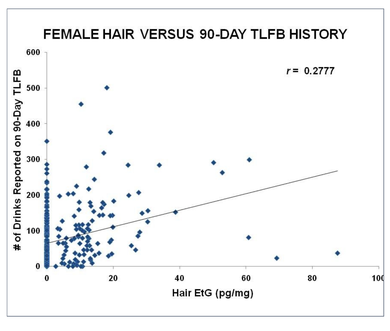
RESULTS





Conclusion: The amount of EtG in both nails and hair of males shows a good correlation to reported alcohol uptake.

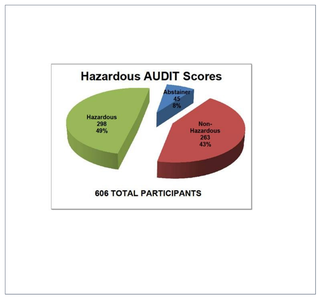




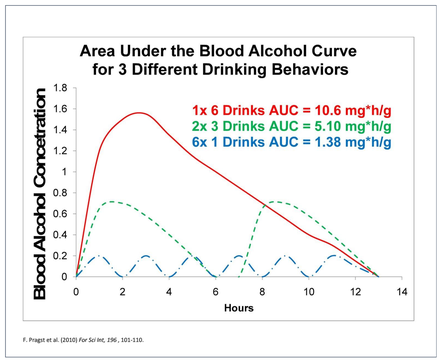
Conclusion: While the amount of EtG in the nails of females shows a good correlation to reported alcohol uptake, the amount of EtG in the hair of females shows a poor correlation to reported alcohol uptake.

RESULTS, cont.

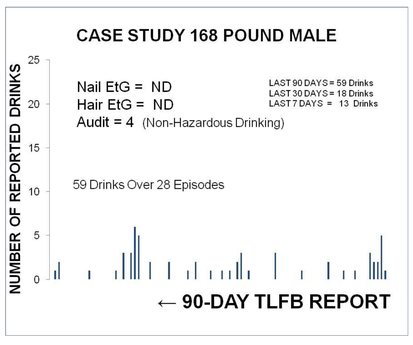
Drinking style can be non-hazardous or hazardous (binge) drinking.



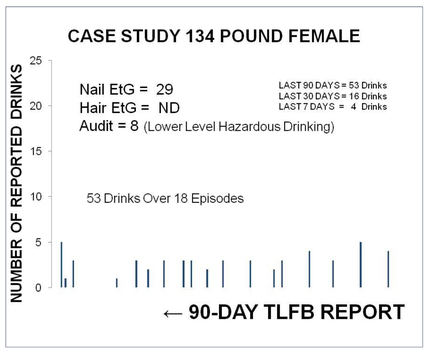
In this study, 43% of the participants reported non-hazardous drinking behavior, while 49% of the participants reported hazardous (binge) drinking behavior.



Drinking style has a major effect on the distribution of an alcohol biomarker into a biological matrix such as nails or hair.



In a case study involving non-hazardous drinking of 59 drinks over 28 episodes, no EtG was detected in the nails of this 168 pound male.



In a case study involving lower level hazardous drinking of 53 drinks over 18 episodes, EtG was detected in the nails of this 134 pound female.

CONCLUSIONS

- There is a gender bias in testing hair for the direct alcohol biomarker EtG
- There appear to be at least two factors that affect the uptake of EtG by nails and hair
  - The actual amount of alcohol consumed over time
  - The drinking style by which the alcohol is consumed (non-hazardous vs. hazardous drinking)

ACKNOWLEDGEMENT

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