

Alcohol Physiology and Pharmacology



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Alcohol Pharmacokinetics

A : Absorption

D : Distribution

M : Metabolism

E : Elimination

Absorption

- Drink is consumed orally (typically)
- 10-20% of the alcohol is absorbed directly through the stomach wall.
- 80-90% is absorbed through the wall of the small intestine.
- Alcohol is a small molecule and does not require digestion to be absorbed.

What can affect absorption?

- Stomach emptying (opening of pyloric sphincter)
- Food
- Type of beverage
- Proof of liquor
- Gastric bypass
- Speed of consumption

What can affect absorption?

- In terms of a DUI, we are concerned with alcohol consumed **within 30 minutes of operation.**
- Some or all may still remain in the stomach
- Does not yet contribute to impairment

Distribution

- Alcohol in the blood is distributed to organs in the rest of the body.
- Enters central nervous system causing impairment
- Circulates through lungs, leaves body via airway

Metabolism

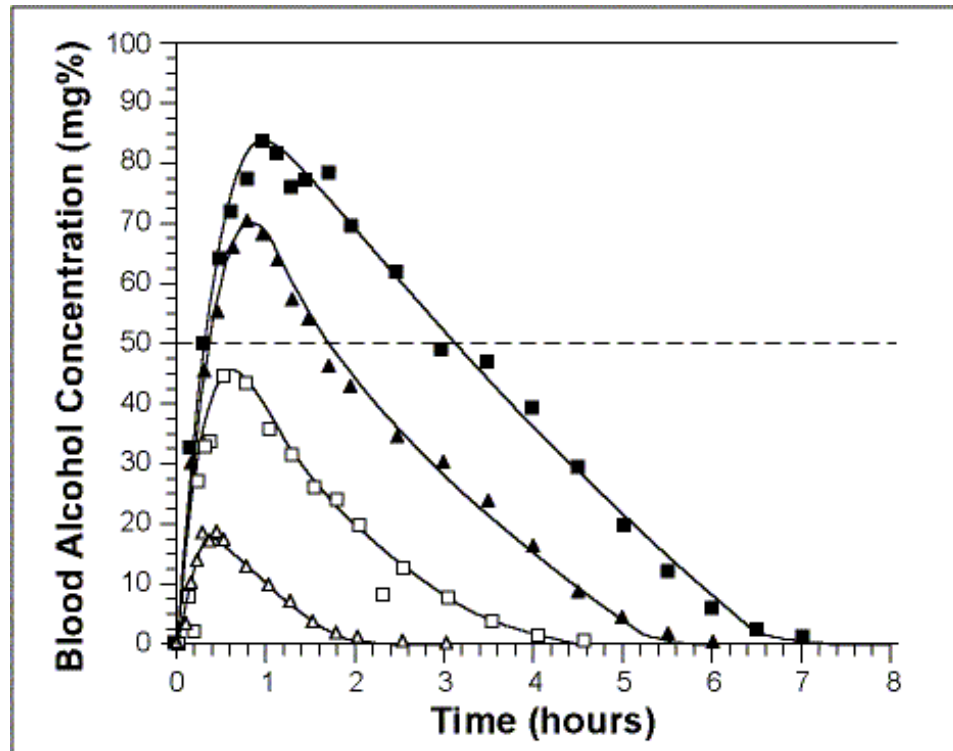
- 97-98% of alcohol eliminated is through the breakdown into its metabolites via ADH (mostly occurs in liver).
- The effective dose of alcohol overwhelms the body's ability to metabolize it away. (Until levels reach below ~0.01%)

Elimination

- Includes excretion of ethanol and its metabolic byproducts.
- 2-3% of ethanol in the body is excreted via sweat, breath and urine.
- Excretion via the lungs allows us to measure alcohol in a breath sample.

Elimination

- The rate of elimination is constant and not dose dependent.



Elimination

- Typical elimination: 0.018-0.022%/hour
- Range: 0.010-0.030%/hour
- Extreme cases: 0.065-0.075%/hour (estimates)
- 0.015%/hour used in calculations as it meets or underestimates the “true” elimination rate of a majority of the population.

What can affect Elimination?

- **Gender:** Women tend to eliminate slightly faster
- **Experience:** Experienced drinkers eliminate faster.
- Person to person variability exists as well as inter-day variability for the same person.
- Some medications and fructose may affect elimination to a minor degree by increasing or decreasing the rate.

What does NOT affect elimination?

- Coffee
- Cold showers
- Exercise
- Sleep

Retrograde Extrapolation

- AKA “relation back”
- A calculation used by chemists to estimate what an individual’s alcohol concentration would have been at the time of **operation**.
- Based on test result, time of test, time of operation and any drinking history available.

Example

- Time of operation: **22:10**
- Time of breath test: **23:45**
- Breath test result: 0.067 %
- Subject: “two beers, two hours ago”

- Time elapsed: **1.583 h**
- Elimination rate: **x 0.015 %/h**
- Ethanol eliminated: **= 0.024 %**

- Estimated BAC at operation: **0.091 % at 22:10**

Predicting BAC

- **Widmark Equation**: Used by chemists to estimate the contribution of a drink to a person's BAC.
- Based on type of beverage, weight and gender of individual.



Retrograde Extrapolation

- The Widmark equation is used when **drinking occurs after or within 30 minutes of operation.**

4. OBSERVATION OF OPERATOR

Odor of intoxicants Strong Moderate Faint None

Eyes Watery Bloodshot Normal

Speech Unintelligible Mumbled Slurred Confused Normal

1. Have you consumed any alcoholic beverages?
 No Yes: How many? _____

★ 2. What time was your first drink? _____

★ 3. What time was your last drink? _____

★ 4. How much, if anything, have you had to drink in the last 30 minutes? _____

5. Have you consumed any drugs or medications? No Yes: What? _____

6. Other observations (e.g. alphabet, counting, etc.): _____

7. Difficulty getting out of vehicle? No Yes: Describe: _____

Standing Falling Extreme Sway Slight Sway Unsteady Steady

Walking Falling Stumbling Unsteady Steady

Alcoholic containers in vehicle? No Yes # _____ Types: _____ Full Empty None

IF OFFICER DID NOT OBSERVE THE OPERATION (Whether crash or not) ASK:

★ Did you drink any alcoholic beverages after driving? No / Yes: How many? _____

★ How much did you drink in the 30 minutes before you stopped driving? _____

Retrograde Extrapolation

7. INTERVIEW

Where were you driving to? _____

Where were you driving from (this time)? _____

➔ How long ago did you drive from that location? _____

What food have you eaten in the last six hours? _____ How long ago did you eat that? _____

➔ What have you been drinking? Beer Liquor Wine – Specific type (brand/name of drink) _____

➔ How many drinks of each kind did you have? _____

➔ What time did you start drinking? _____ What time did you stop drinking? _____

➔ How much if anything did you drink in the 30 minutes before you stopped driving? _____

Who were you drinking with? (**obtain names**) _____

Where (**specific location**) were you drinking? _____

➔ How much do you weigh? _____ Are you tired? No Yes

Are you ill? No Yes, if so describe: _____

Do you have any physical handicaps? No Yes, if so describe: _____

Do you limp? No Yes Do you have diabetes? No Yes Taking insulin? No Yes

Do you have epilepsy? No Yes

Have you been injured lately? No Yes, if so describe: _____

Do you wear glasses? No Yes Do you wear contact lenses? No Yes

In the last 24 hours have you taken any medications or drugs? No Yes

Were the drugs/medications affecting your driving? No Slightly Moderately Substantially

Please describe what drug/medication and the dosage/amount consumed? _____

Are you under the influence of drugs right now? No Slightly Moderately Substantially

Are you under the influence of alcohol now? No Slightly Moderately Substantially

Were you under the influence of drugs while driving the vehicle? No Slightly Moderately Substantially

Were you under the influence of alcohol while driving the vehicle? No Slightly Moderately Substantially

Were you feeling the effects of the alcohol while driving the vehicle? No Slightly Moderately Substantially

Were you feeling the effects of the drug(s) while driving the vehicle? No Slightly Moderately Substantially

Have you been convicted of Driving Under the Influence in VT or any other State? No Yes

If YES, where and when? _____

Are you currently on Probation? No Yes Are you currently on Conditions of Release? No Yes

OTHER QUESTIONS/ANSWERS (Re: DUI or any OTHER OFFENSES involved) use supplemental page.

Example

- Time of operation: 22:10
- Time of breath test: 23:45
- Breath test result: 0.067 %
- Subject: Male, 185 lbs.
“two beers, two hours ago...
...oh, and a Twisted Tea tallboy while driving 10 minutes ago.”
- Relation back estimate: **0.091 %**

Example

- Relation back estimate: **0.091 %**
- Contribution of alcohol consumed within 30 minutes:
- **24 oz. Twisted Tea x 5.0% ABV = 1.2 oz. ethanol**
- 185 lb male (ρ value = 0.68)
- Widmark equation = **0.052 %**
- Subtract from relation back estimate: $0.091 - 0.052 =$
0.039 % at 22:10

The Standard Drink

- A standard drink is the equivalent dose of beer, wine and liquor which yield the same BAC.



The Myth of the Standard Drink

- Why is it a myth?
- Drinks are not always poured to the same amount.
- Alcohol concentrations of beer and wine vary.
- Home mixed drinks are substantially stronger than those served at an establishment.

The Myth of the Standard Drink

- A “standard” drink will be used by the chemist when no other information is given about what was actually consumed.
- Keep in mind that a beer is not a beer. There can be great variations.
- The more information you can gather about alcohol consumed within 30 minutes prior to (or possibly after) **operation**, the better.

Retrograde Extrapolation

A relation back estimate is required:

- 1) The test occurs more than 2 hours from the time of operation.
- 2) The test result is below a 0.080.
- 3) A drink has been consumed after or within 30 minutes of operation.

Requesting a Relation Back Affidavit

Scan and email or fax the following documents:

- 1) 4 page DUI processing forms
- 2) 1A Supplemental Affidavit
- 3) Evidence ticket(s)
- 4) Arrest custody report (or some document which contains the subject's weight)

DPS.DMT@vermont.gov

or

241-5557 (fax)

Requesting a Relation Back Affidavit

- Ensure you include in your request a **valid email address** for the remittance of the completed affidavit and **your contact information** in case there are questions regarding the submission.
- Ensure that all information contained in your affidavit and supporting documents is accurate especially case number, subject's name, time of operation and time of test.