

Alcohol Metabolism

Mainly two types

Ethanol – **Grain alcohol** nutritionally significant

Produce by fermentation of carbohydrates

Used as a food, disinfectant,

preservative, organic solvent, fuel

Methanol – **Wood alcohol** (toxic)

Beverage	Source of CHO	Alcohol content g/dl
Beer	Barely	2-7
Cider	Apple	3-10
Wine	Grape	9-10
Arack	Palm sap	30-31

Objectives

At the end of the lecture you should be able to;

- briefly explain the mechanisms involved in metabolism of ethanol.
- briefly discuss the effect of alcohol on the body.
- briefly explain the metabolism of methanol.

Absorption of Ethanol

- Absorb rapidly - Stomach 20% , Intestine 80%
- Chinese & North Americans Indians rapid than Caucasians
- Slow absorption when taken slowly with foods or milk and cream
- Once absorb rapidly distribute in to body water space

Absorbed
by passive diffusion



Blood

85- 95% Liver

5-10% excreted through
lungs / kidney

5%

Metabolized in gastric mucosal cell
1st pass metabolism

Absorbed in the lung & percutaneous

Fate of Ethanol after consumed

Upper GIT

First Pass Metabolism

Ethanol  Acetaldehyde

Alcohol Dehydrogenase
ADH

Activity of Gastric ADH.

Reduce in Women and heavy drinkers

Test for drunkenness

Breathalyzer test

Estimation of blood ethanol concentration from measurement breath ethanol.

The ratio between alcohol in Blood & Alveolar air (in deep expiration) is relatively constant

1 ml of blood will contain nearly the same amount of alcohol as 2,100 ml of alveoli breath

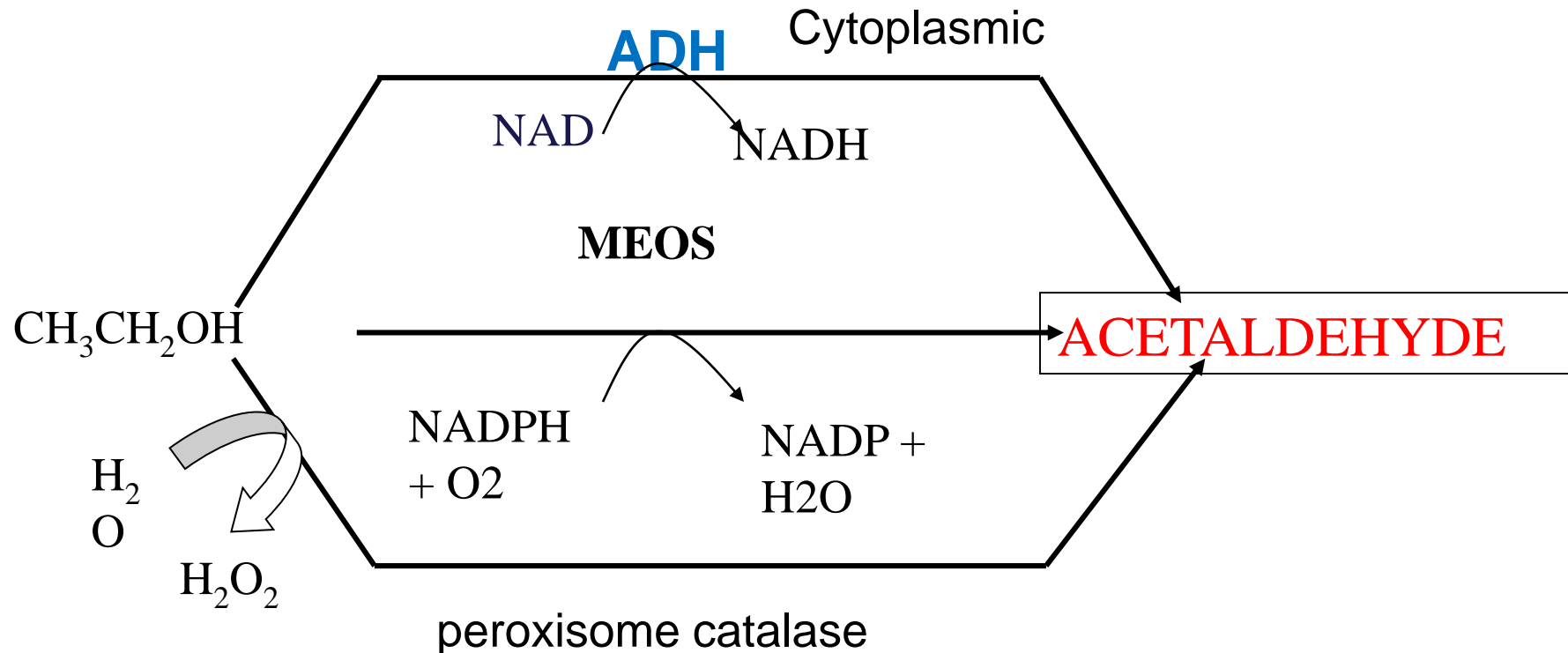
Ratio 2100 : 1

Alveolar : blood

Con; in urine?

Metabolism in the liver

1. Alcohol dehydrogenase (ADH)
2. Microsomal oxidizing system (MEOS)
3. Peroxisome catalase



ADH

Exist as isoenzymes with varying specificity for length of alcohol.

Class I- ADH(1,2,3 allelic variant)

Class II- ADH4

Class III -ADH5

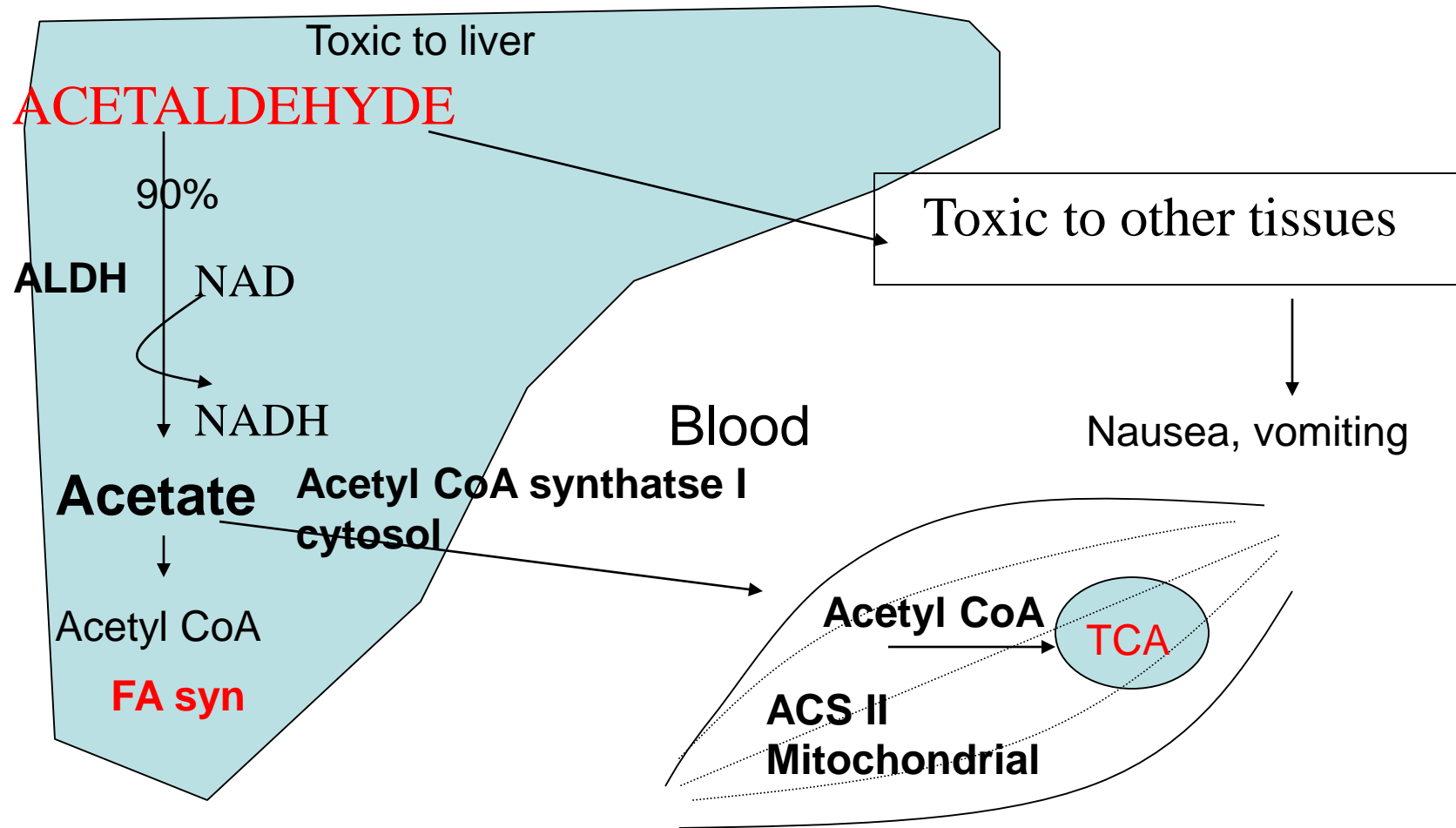
Class IV- ADH7

Class I

Shows highest affinity for ethanol.

Main ADH in Liver

Metabolism in the liver



ALDH – acetaldehyde dehydrogenase

Acetaldehyde dehydrogenase (ALDH)

- More than 80% of acetaldehyde oxidized by liver ALDH (mitochondrial).
- ALDH (cytosolic) act on organic alcohol, toxins.
- Inactive ALDH ??.....
- ALDH inhibitor use to treat alcoholics.
(eg; **DISULFIRAM**)

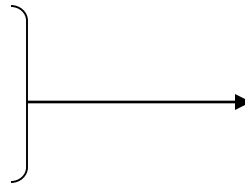
Microsomal oxidizing system (MEOS)

- Cytochrome p450 mixed function oxidase family.
- Main enzyme responsible for ethanol is CYP2E1.
- Hepatic CYP2E1 increases in chronic alcoholics.

- Negative consequences of CYP2E1

High Acetaldehyde

Formation of free radicals



Hepatic injury



Variations in pattern of Ethanol Metabolism

Rate & route of oxidation

Genotype-

Drinking Hx-

moderate to heavy and chronic ADH Decrease

MEOS Increase

Gender- High levels in females

Quantity- Small amount –ADH

Higher amount in short period MEOS

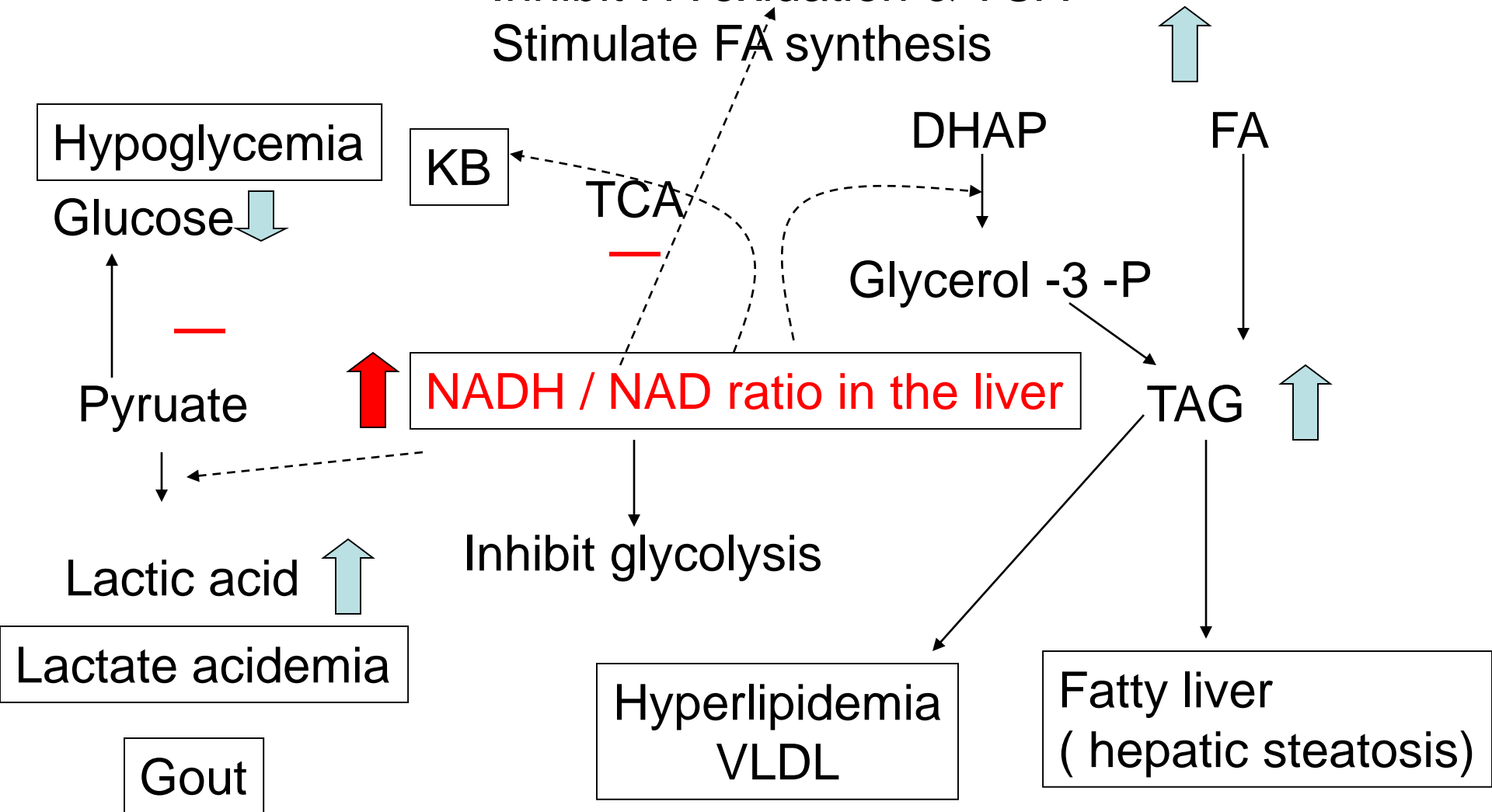
Toxic effect of Alcohol

Acute effect- NADH

- Changes in fatty acid metabolism
- Ketoacidosis
- Lactic acidosis
- Hyperuricemia
- Hypoglycemia

Toxic effect of ethanol metabolism

Acute effect : Inhibit FA oxidation & TCA
Stimulate FA synthesis



Effects of Alcohol

- Impaired Judgment
 - Amnesia
 - Anxiety
 - Increased Urination
- Flushing (Red-Faced)
 - Disrupted Balance
 - Hangovers, Nausea, & Dehydration

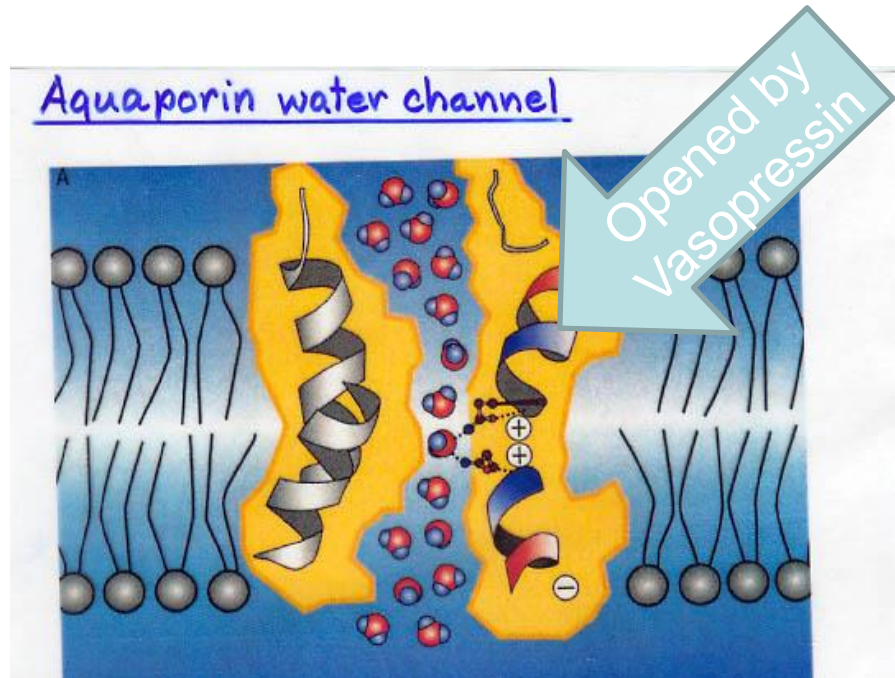
Flushing

- Because acetaldehyde can cause an inflammation response



Dehydration

- Alcohol is a diuretic and causes cells to shed water.



- Alcohol inhibits the function of vasopressin

Nausea & Stomach Ache

- Stomach Irritation is largely due to excess production of HCl
- If the pH of the stomach drops too much or too fast (or both), it will cause vomiting, diarrhea, or both

Headache

- A headache can be due to numerous effects of alcohol, including –
 - Inflammation of blood vessels, creating pressure in the skull
 - Dehydration
 - Acetaldehyde's presence in the blood
 - Increased stimulation and anxiety caused by glutamine resurgence
 - Stress from nausea
 - A combination of all these and more

Alcohol on Central nervous system

- Enhance GABA mediated inhibition.
 - Inhibit the voltage sensitive Ca channels in neurons.
 - Inhibit NMDA receptor function
Slurred speech, Motor incoordination,
Increase self confidence, euphoria.
- Effect on mood varies, Impair intellectual performances.

TABLE H7-2**Alcohol Blood Levels and Brain Responses****Blood Alcohol
Concentration****Effect on Brain**

0.05	Impaired judgment, relaxed inhibitions, altered mood, increased heart rate
0.10	Impaired coordination, delayed reaction time, exaggerated emotions, impaired peripheral vision, impaired ability to operate a vehicle
0.15	Slurred speech, blurred vision, staggered walk, seriously impaired coordination and judgment
0.20	Double vision, inability to walk
0.30	Uninhibited behavior, stupor, confusion, inability to comprehend
0.40 to 0.60	Unconsciousness, shock, coma, death (cardiac or respiratory failure)

NOTE: Blood alcohol concentration depends on a number of factors, including alcohol in the beverage, the rate of consumption, the person's gender, and body weight. For example, a 100-pound female can become legally drunk (≥ 0.10 concentration) by drinking three beers in an hour, whereas a 220-pound male consuming that amount at the same rate would have a 0.05 blood alcohol concentration.

Secondary deficiencies

Primary malabsorption;

Ca, Folic acid ,B12 AA

Secondary malabsorption;

Pancreatic insufficiency,

Impaired hepatic metabolism

Reduce synthesis of transport proteins

Foetal alcoholic syndrome

Seen in women taking more than 10 units of alcohol (80g of ethanol/ day)

Results

- Intrauterine growth retardation
 - Developmental abnormalities.
 - Other congenital abnormalities.
 - 1:1000 live babies may be fully affected.
-
- The effects are more profound when mothers are smoking.

Metabolisms of methanol

