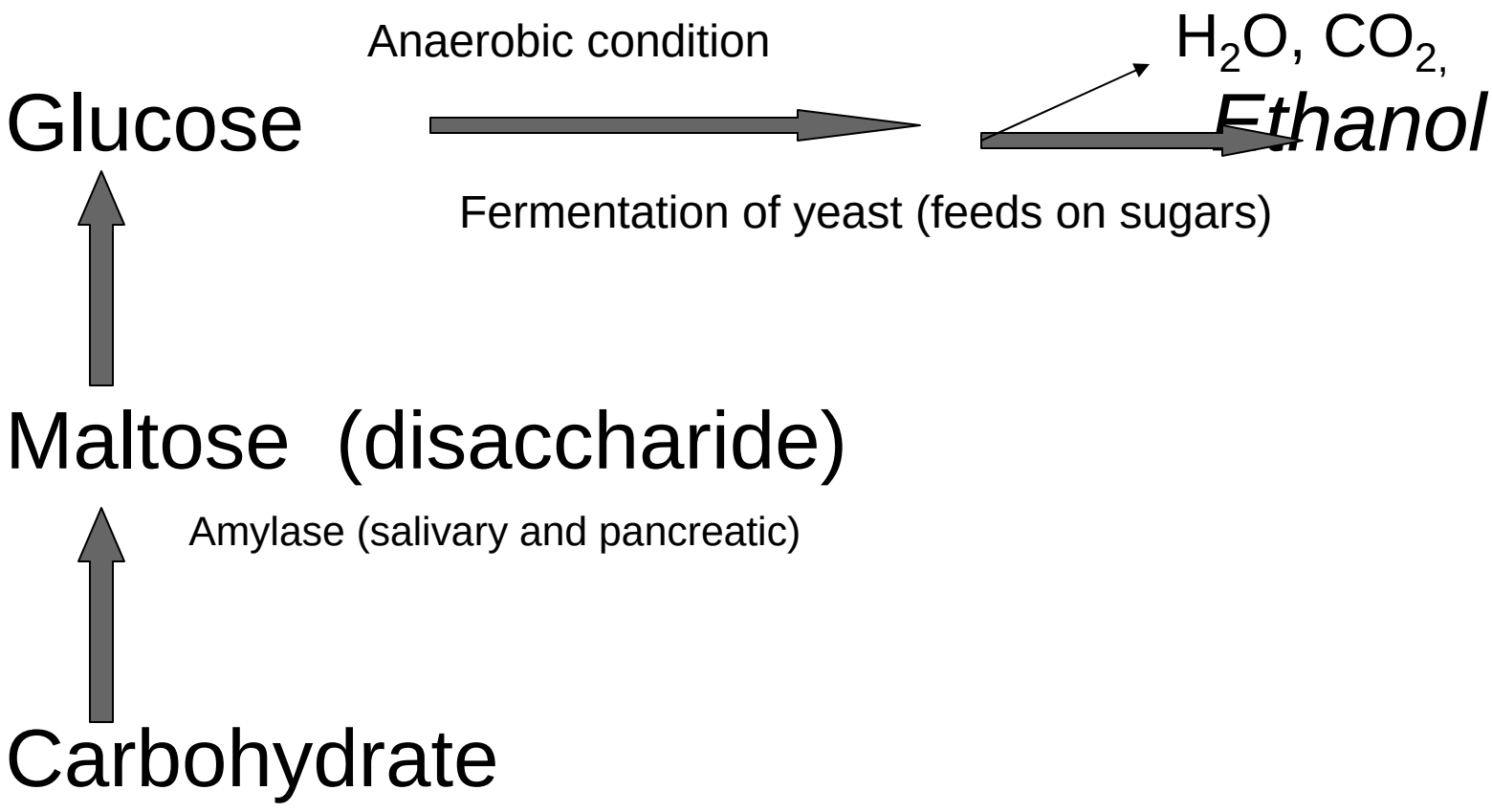
Contemporary Nutrition

Chapter 7, ***Alcohol***

Fermentation

- Breaks down CHO without oxygen
  - Anaerobically
  - Temperature
  - Food composition
- Yeast
  - Microorganism responsible for alcohol production
  - Brewer’s yeast

Production of Alcohol



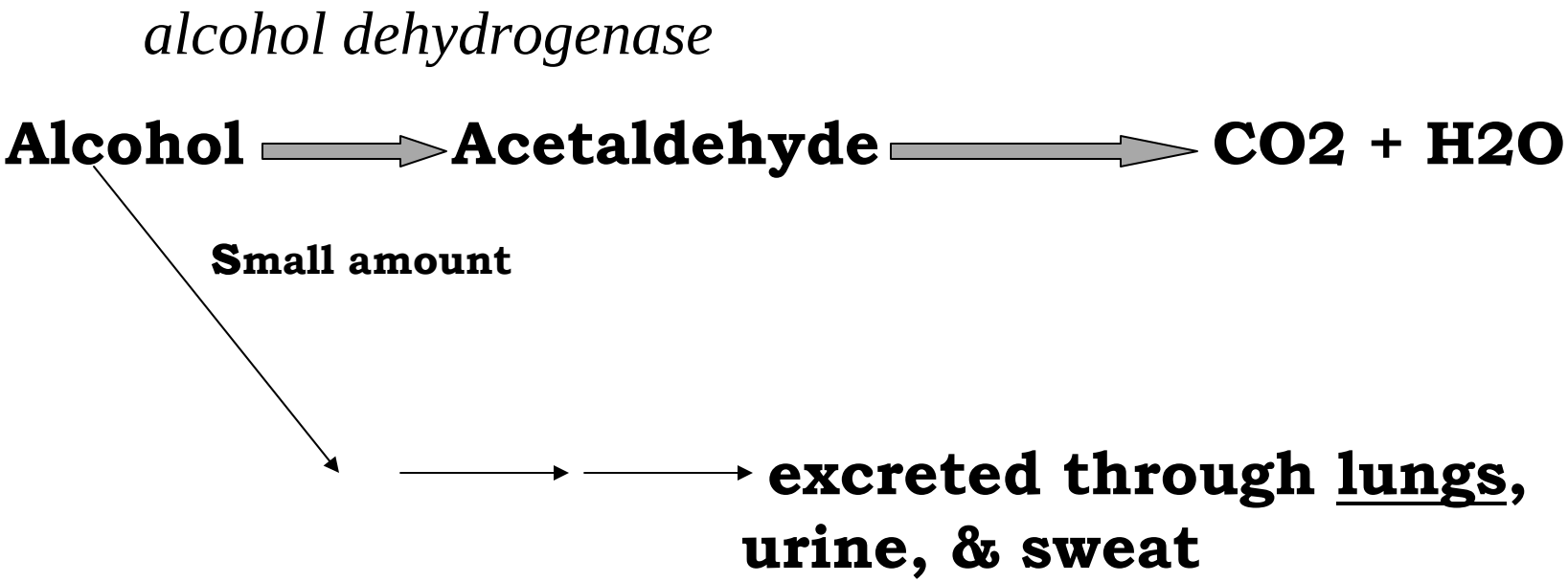
Alcohol Absorption

- Absorbed rapidly via simple diffusion
- Depends on rate of stomach emptying
  - 20-25% of the ethanol can reach brain in 1 minute (stomach empty)
- Rate of absorption
  - Wine → liqueur → beer (slowest)
- Alcohol is found wherever water is found in the body
- Easily moves through the cell membrane (damaging proteins)

Alcohol (Ethanol) Metabolism

- Majority is metabolized by the liver
  - Produces the most alcohol dehydrogenase to oxidize alcohol
- Alcohol cannot be stored
- Alcohol has priority in metabolism
  - Liver packages TG-send throughout body
  - FA build up while liver metabolizes alcohol
  - Changes liver cell structure
  - Impairs ability to metabolize fat
  - Fatty livers in alcoholics

Metabolism of Moderate Alcohol Intake



Alcohol (Ethanol) Metabolism

- Excess alcohol intake
  - Alternate pathways to metabolize because
    - NAD unavailable
    - Accumulation of H^+
    - Buildup of lactic acid
    - ADH unable to keep up

Alcohol (Ethanol) Metabolism

- Excess alcohol intake
  - Alternate pathways
    - Microsomal ethanol oxidizing system (MEOS)
      - Cytosol
      - Requires energy
      - Reduces body's ability to detoxify drugs
        - Drug overdose
      - Allows body to handle more alcohol
        - Tolerance

Alcohol (Ethanol) Metabolism

- Depends on
  - Race
    - Asians, Native Americans
  - Gender
    - Women are smaller
    - Have less body water
    - Less alcohol dehydrogenase
    - Develop more alcohol-related ailments
  - Food

Ethnicity and Alcohol Dependency

- Asians and Native Americans
  - Very susceptible compared to Caucasians
- Major cause of death for Native Americans
  - Alcohol-related motor vehicle accidents
  - Suicide, homicide, domestic abuse
- African American Alcoholics
  - Greater risk for tuberculosis, hepatitis C, HIV/AIDS
- Hispanic American Alcoholics
  - Greater risk for cirrhosis-related deaths

Benefits of Moderate Alcohol Consumption

- One drink:
  - 12 oz beer or wine cooler
  - 5 oz wine
  - 3 oz sherry or liqueur
  - 1.5 oz 80-proof distilled spirits
- Decrease risk for cardiovascular disease
- Socialization

Moderate Drinking

- Nondrinkers
  - Should not start drinking (for health)
- Moderation:
  - No more than 1 drink a day for women and older adults
  - No more than 2 drinks per day for men

Guidance Regarding Alcohol

- Dietary Guidelines for Americans
  - Moderation
  - Lower risk for CVD
  - Little benefits for younger people
- Drink with meals
- Don’t drink and drive
- Avoid drinking while pregnant

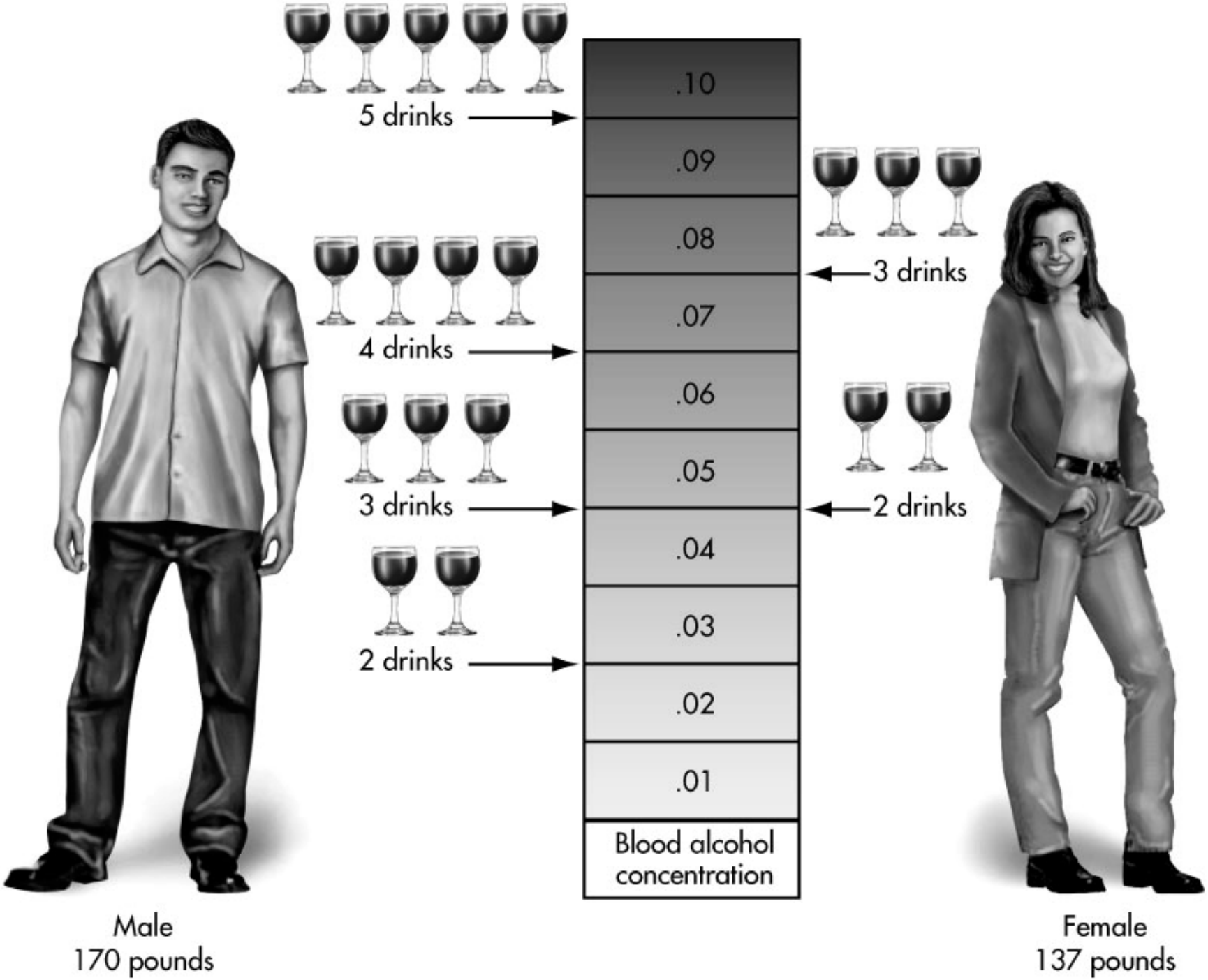


Table 7.2

Table 7-2 Blood Alcohol Concentration and Symptoms

Concentration*	Sporadic Drinker	Chronic Drinker	Hours for Alcohol to Be Metabolized**
50 (party high) (0.05%)	Congenial euphoria; decreased tension; noticeable impairment in driving and coordination	No observable effect	2–3
75 (0.075%)	Gregarious	Often no effect	3–4
80 to 100 (0.08%–0.1%)	Uncoordinated; 0.08% is legally drunk (as in drunk driving) in the United States and Canada.	Minimal signs	4–6
125–150 (0.125%–0.15%)	Unrestrained behavior; episodic uncontrolled behavior	Pleasurable euphoria or beginning of uncoordination	6–10
200–250 (0.2%–0.25%)	Alertness lost; lethargic	Effort is required to maintain emotional and motor control	10–24
300–350 (0.3%–0.35%)	Stupor to coma	Drowsy and slow	10–24
>500 (>0.5%)	Some will die	Coma	>24

*Milligrams of alcohol per 100 milliliters of blood.

**Social drinker. Alcohol metabolism is somewhat faster in chronic alcohol abusers.

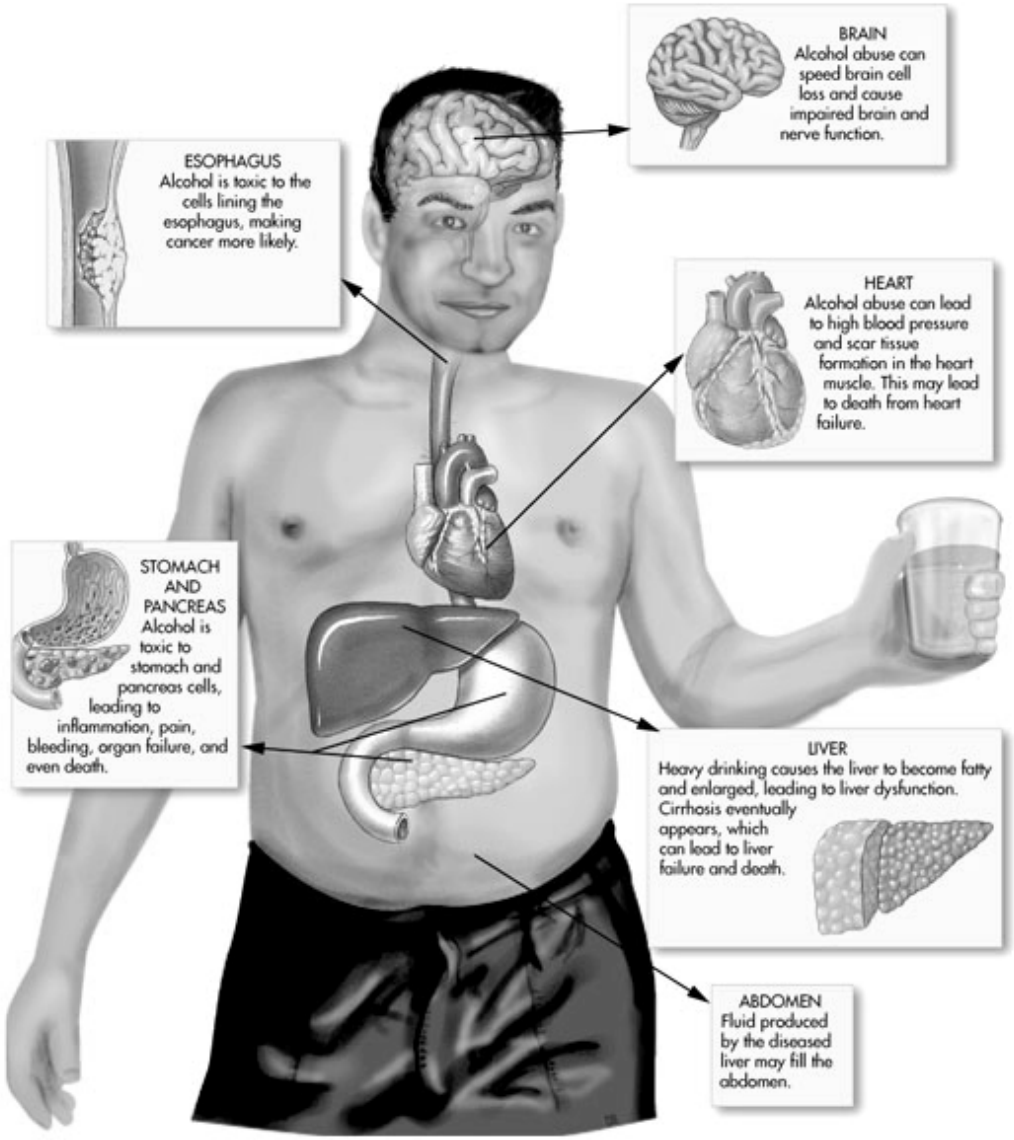
Modified from Wyngaarder JB, Smith LH: *Cecil Textbook of Medicine*, fourth edition, Philadelphia, 1988, WB Saunders. Used with permission.

RESULTS OF MODERATE ALCOHOL USAGE

- Hypertriglyceridemia
- Hypertension
- Stroke
- Decreased immune function
- Accidents
- Suicide
- Breast cancer
- Colon cancer
- Menstrual pain
- Osteoporosis
- Obesity

- Gastritis
- Gout
- Chronic fatigue
- Cerebral atrophy
- Fetal alcohol syndrome
- Leukemia in offspring
- Potentiates heavy drinking
- Decreases judgment, foresight, moral reasoning

Effects of Alcohol



Benefits and Risks

Table 7-3 A Summary of Benefits and Risks of Alcohol Use

	Moderate Use*	Alcohol Abuse**
Coronary heart disease	Decreased risk of death in those at high risk for coronary heart disease-related death, primarily by increasing HDL-cholesterol in some people, decreasing blood clotting, and relaxing blood vessels	Heart rhythm disturbances, heart muscle damage, increased blood triglycerides
Hypertension and stroke	Mild decrease in blood pressure; less ischemic stroke in people with normal blood pressure	Increased blood pressure (hypertension); more hemorrhagic stroke
Peripheral vascular disease	Decreased risk due to reduced blood clotting	No benefit
Blood glucose regulation and type 2 diabetes	Decreased risk of death from cardiovascular disease	Hypoglycemia; reduced insulin sensitivity; damage to pancreas (site of insulin production)
Bone and joint health	Some increase in bone mineral content in women, linked to estrogen output	Loss of active bone-forming cells and eventual osteoporosis (many nutrient deficiencies also contribute to this problem); increased risk of gout
Brain function	Enhanced brain function and decreased risk of dementia by increasing blood circulation in the brain	Brain tissue damage and decreased memory
Skeletal muscle health	No benefit	Skeletal muscle damage
Cancer	No benefit	Increased risk of oral, esophageal, stomach, liver, lung, colorectal, and breast cancer, to name a few (especially if the diet is deficient in the vitamin folate)
Liver function	No benefit	Fat infiltration and eventual liver cirrhosis, especially if a person is also infected with hepatitis C; iron toxicity
GI tract disease	Decreased risk of certain bacterial infections in the stomach	Inflammation of the stomach (and pancreas); absorptive cell damage leading to malabsorption of nutrients

Alcohol Abuse

- Contributes to 5 of 10 leading causes of death
  - Heart failure, some cancers, cirrhosis, accidents, suicides
- When combined with tobacco
  - Increases the risk for esophageal and oral cancer
- Increased risk for:
  - Heart damage, arrhythmia, hypertension, stroke, osteoporosis, brain damage, colorectal cancer, breast cancer, nutritional deficiencies, fetal damage, obesity, impotence, sleep disturbances, infections, hypoglycemia

Alcohol Dependence

- Addictive and dangerous
- Genetic influence
  - Tolerance to alcohol
  - Be aware of alcohol consumption
  - Children of alcoholics are 4x more likely to become alcoholics themselves
  - Warn children of alcoholic families of the dangers by age 10
- Long-term drinking poses risk for all
  - Drinking increasing quantities

Alcohol Dependence

- Most common psychiatric disorder
- Affects 13% of North Americans
- Costs
  - Lost of productivity
  - Premature deaths
  - Direct treatment expenses
  - Legal fees
  - $150,000 for liver transplant

Depression and Alcohol Abuse

- The more symptoms of depression, the heavier the drinking
- “Self-medication” with alcohol
  - Alcohol may increase serotonin and dopamine
  - Alcohol is actually a depressant
- No longer concerned about the effects of alcohol

Damage to GI Tract

- Damage to cells lining small intestine
- Overabsorption of iron
  - Deficiency – GI lesions that bleed
- Malabsorption of nutrients
- Diarrhea
- Inflammation of pancreas and gall bladder
  - Decrease of enzymes
  - Decrease bile production

CHO Metabolism

- Depresses intestinal disaccharidase activities
  - Sucrase, maltase, lactase
- Correlates to hyperglycemia
  - Increased NADH:NAD ratio due to alcohol metabolism
  - Glycolysis slowed

Lipid Metabolism

- Increased fat synthesis, fatty liver
  - Destroys cells, replaced with scar tissue
    - Cirrhosis
- Increase in blood triglycerides
- Increase in cholesterol
  - VLDL, HDL

Protein Metabolism

- Interferes with amino acid absorption (GI)
- Increase in urea nitrogen
- Impairs liver amino acid uptake
- Decreases gluconeogenesis

Water-Soluble Vitamins

- Thiamin deficiency
  - Polyneuropathy
- Niacin deficiency
  - Alcohol uses large amounts of NAD during metabolism
- Vitamin B 6 – coenzymes
  - Metabolism (CHO, Fat, Protein)
  - Synthesis of Hb,
    - Decrease in RBC, anemia
- Vitamin C
  - Scurvy

Fat-Soluble Vitamins

- Vitamin A
  - Night blindness
- Vitamin D
  - Decrease in bone density
- Vitamin K
  - Drop in blood levels of clotting factors

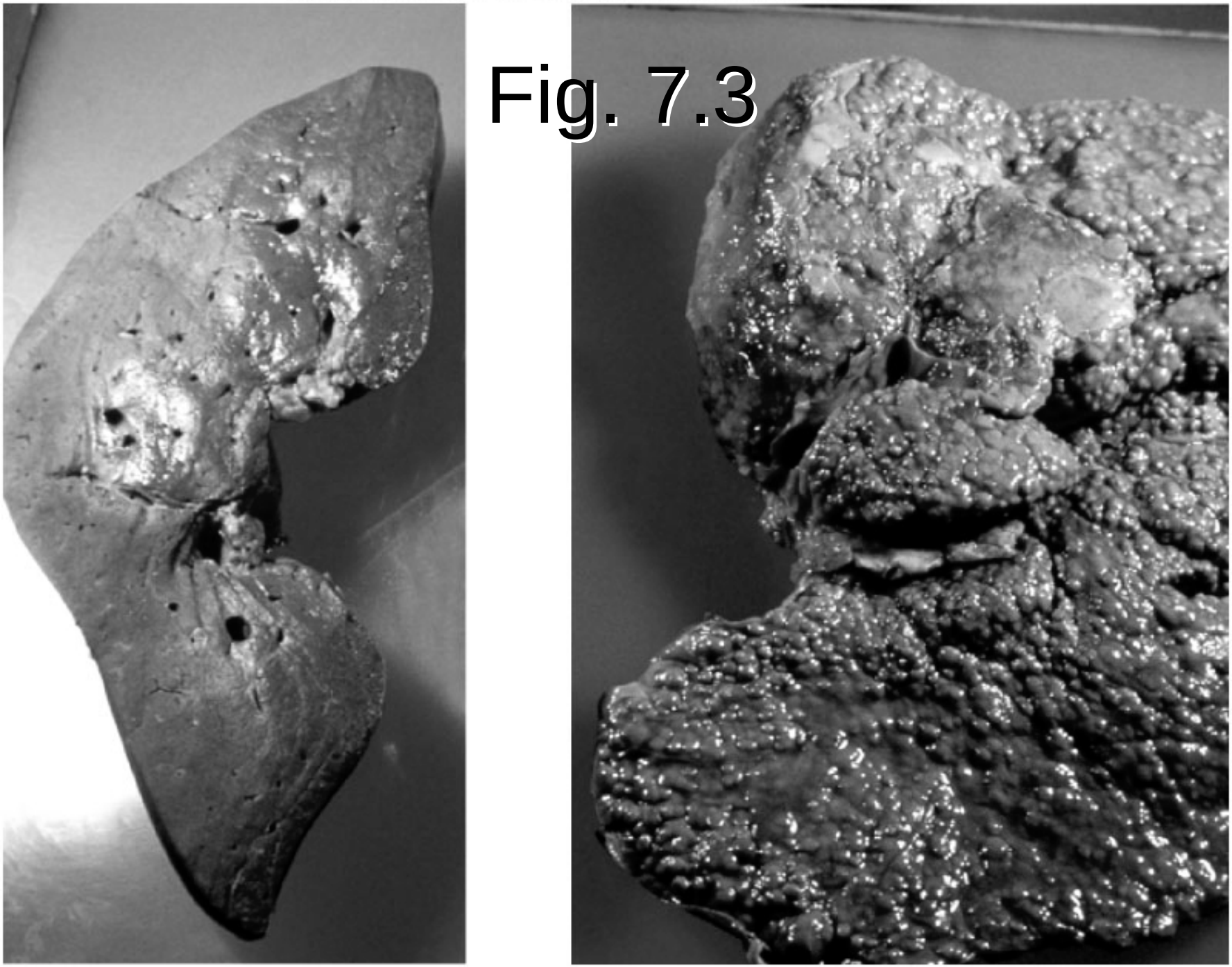
Minerals

- Magnesium (enzyme function)
  - Hallucinations
  - Impaired CNS
- Zinc (cofactor in enzymes)
  - Night vision impairment
  - Impaired wound healing

Cirrhosis

- Fatty infiltration of the liver
- Increased synthesis of fat
- Enlarged fat cells
  - Choke off nutrient and O_2 supply to liver cells
  - Engorged fat cells burst and die
- Scar tissues
- 50% chance of death within 4 years
- Advanced stages are not reversible
- Destruction of vital tissues regardless of diet

Fig. 7.3



Brain Damage

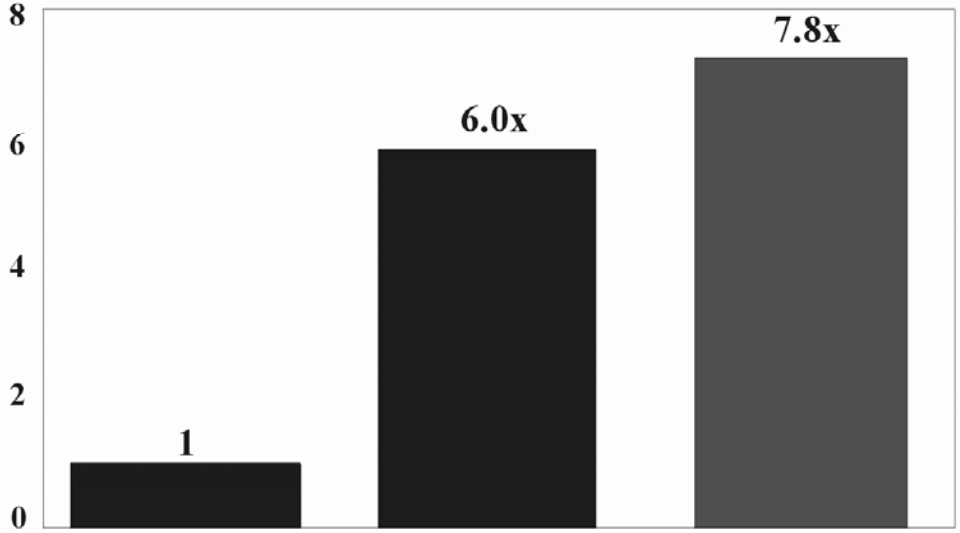
- Cognitive dysfunction
- Motor nerve deficit
- Shrinks brain
- Reduces oxygen and nutrients to brain

ALCOHOL AND STROKE

- **Increased strokes caused by brain hemorrhage occurred in drinkers irrespective of blood pressure level.**
- **Even light drinkers of 1 to 14 ounces of alcohol per month showed more than two times the risk of non-drinkers.**

MODERATE DRINKING AND STROKE IN YOUNG ADULTS

Young adults (16 to 40 years old) who drink 2 to 3 drinks or more (40g ethanol) significantly increase their risk of stroke within 24 hours.



Fetal Alcohol Syndrome

- Avoidable
- Ethanol crosses placenta-fetal circulation
- Deprives brain of oxygen, nutrients
- Abstinence

LIGHT DRINKING WEAKENS THE IMMUNE SYSTEM

The body's ability to fight bacteria and viruses is reduced by 67 percent in light drinkers with only two drinks.

ALCOHOL INCREASES CANCER IN RATS

1. Rats were injected with breast cancer cells.
2. Some drank alcoholic drinks to produce a blood level of 0.15%, equal to 4 or 5 drinks per hour for a human.

3. Others drank more, producing a 0.25% blood level.
4. A third group drank no alcohol.
5. Those that drank at the lower level had twice as many cancerous tumors as the non-drinking rats.
6. The higher level drinkers had 8 times as many tumors.

Conclusion: The harmful effects of alcohol on cancer may be vastly underestimated.

Diagnosis

- Physiological dependence on alcohol
- Tolerance to the effects of alcohol
- Alcohol-associated illnesses (memory loss, liver disease, etc.)
- Continued drinking in defiance of medical and social contraindications
- Depression and blackouts
- Flushed face/reddened skin

Screening

- Have you had memory lapses or blackouts?
- Do you continue to drink even though you have health problems caused by alcohol?
- Do you get withdrawal symptoms?
- Do you take part in high-risk behaviors?
- Has drinking caused trouble in your personal life?
- Do you drink to
  - get through the day?
  - cope?
  - escape?

Binge Drinking

- 4-5 or more drinks in a row
- Practiced by ~50% of college students
- Acute alcohol intoxication
- Death, accidents, unsafe sex, assaults, destruction of property, injuries, suicide, academic problems
- Can cause life-long problems

Alcohol Poisoning

- Warning Signs
  - Semiconsciousness or unconsciousness
  - Slow respiration (8 or fewer breaths per min. or lapse greater than 8 sec.)
  - Cold, clammy, pale, or even bluish skin
  - Strong odor of alcohol
  - Others?

Binge Drinking

- www.health.org/govpubs/rpo995/
  - Binge drinking often begins age 13
  - Peaks 18-22 years
  - 12-20 years of age – 15% binge, 7% heavy

Binge Drinking

- 1998 National Survey on Drub Abuse
  - 10.4 million adolescents used alcohol
    - 5.1 million binge
    - 2.3 heavy (binged 5 times/month)
  - 12-17 year olds
    - 9% boys 7% girls – binged on alcohol previous month

Binge Drinking

- 12-17 year olds – white, non-Hispanic youth
  - 9% binge drinking
- 12-17 year olds – Hispanic youth
  - 6% binge drinking
- 12-17 year olds – black, non-Hispanic youth
  - 3%
- 12-17 year olds binge drinking
  - Most frequent occurrence in
    - North Central US
    - Metropolitan areas

PUBLIC ENEMY NO.

1. Alcoholic beverages are regarded by social analysts as America's number one public enemy.

2. This "beloved enemy" claims at least 100,000 American lives per year.

3. This is five times as many as all illegal drugs combined.

DOLLARS SPENT ON ALCOHOL

1. More than 86 billion dollars are spent annually to purchase alcoholic beverages.

2. As much as 116 billion dollars are spent annually for the cost of damage to society from alcohol (divorce courts, health care, lost work, premature deaths, etc.).

3. All told, the total annual cost of alcoholic beverages is $202,000,000,000.

Treatment

- Guidance from a physician
- Counseling
- Total abstinence
- AA 12-step program
- Treatment programs
- Medication (blocks craving or causes physical reaction when drinking)

“Apparent Health Benefits”

- Finding
  - Those who drink in moderation live longer
  - Evidence that it was BECAUSE they drank that they lived longer-????
- Assumption
  - Moderate drinkers = teetotalers
    - Exception – alcohol
- Confounders not evaluated

“Apparent Health Benefits”

- Naimi et al. (2005) CV risk factors and confounders among nondrinking and moderate drinking US adults. Am J Prev Med. 28 (4).

	Nondrinkers	Mod drinkers
Diabetes	11.4%	4.6%
Obesity	17.0%	14.0%
Hi Chol	36.1%	32.4%
Heart disease	5.0%	1.9%

“Apparent Health Benefits”

	Nondrinkers	Mod drinkers
College	22.7%	38.8%
>$50,000	28.7%	49.3%
Hobbies	68.1%	82.3%
Exercise	78.6%	89.9%
Risk CV	23.5%	29.0%

“Apparent Health Benefits”

- Moderate drinkers had:
  - College degrees,
  - higher income were less obese,
  - had lower cholesterol levels
  - a lower risk of heart attacks and stroke