Nutrition and Nutraceuticals

Chapter 9
Chapter Overview

- Nutrient-drug interactions
- Nutritional management
- Neutraceuticals
  - Fiber
  - Vitamins and minerals
  - Fatty acids
  - Plant sterols
  - Pro- and symbiotics
Nutrient-Drug Interactions

- Food may affect drug:
  - Absorption
  - Metabolism
  - Excretion
- Drugs may affect nutrient status
Influence of Diet on Drug Absorption

- Drug absorption can be decreased, delayed, accelerated or increased by food
- Food in the GI tract at the time of drug administration affects absorption and bioavailability
- Food changes gastric pH
- Food may bind with medication decreasing absorption (ie. tetracycline and milk)
- Some foods are better absorbed with food (griseofulvin)
Influence of Diet on Drug Metabolism

- The rate of drug metabolism in both is affected by nutrient intake
  - Low-carbohydrate, high-protein diet may increase drug-metabolizing enzymes
  - Antioxidant cruciferous vegetables may increase the activity of drug-metabolizing enzymes
- Grapefruit Juice and CYP3A4
  - Grapefruit juice contains components that inhibit CYP3A4 (furanocoumarins)
  - Increased levels of calcium channel blockers, cyclosporine, tacrolimus, and the statins
- Foods and CYP1A2
  - Vegetables (cruciferous), methylxanthine-containing beverages (caffeine), and charcoal broiling may lead to therapeutic failure
Influence of Diet on Drug Excretion

- Some foods can change urinary pH affecting drug excretion
- Foods that alkalinize the urine:
  - milk, vegetables, and citrus fruits
- Foods that acidify the urine:
  - meat, fish, cheese, and eggs
Drug–Food Incompatibilities

- Warfarin
  - Vitamin K containing foods
- MAOI
  - Tyramine-containing foods (fermented, pickled, etc)
- Metronidazole
  - Alcohol
- Caffeine
- Alcohol
Influence of Drugs on Nutrients

- Drug-Induced Nutrient Depletion
  - antacid therapy or potassium therapy can reduce absorption of folic acid, iron, and vitamin $B_{12}$
  - phenytoin reduces the level of folic acid
  - Loop diuretics affect sodium, calcium, and potassium levels
Recognizing Drug-Food Interactions

- Use up-to-date resources to evaluate the potential for drug–food interactions.
- Seek out educational materials that can provide accurate and appropriate drug information to patients.
- Consult with other practitioners, pharmacists, and registered dietitians to identify drug–nutrient interactions.
- Get a complete patient profile in terms of drug, herb, and nutrient intake.
  - prescribed, over the counter, herbs, vitamins, alcohol, nutrient supplements
Nutritional Management

- Consult with a registered dietitian
- American Dietetic Association (ADA) recommended populations who need supplements
  - Infants and children, including adolescents, need 400 IU of vitamin D daily.
  - Women of childbearing age who may become pregnant need 400 mcg/day of folic acid.
  - Pregnant women need folic acid 600 mcg/day, a multivitamin/mineral supplement, 27 mg/day of iron (60 mg/d if patient is anemic), and vitamin B₁₂ if the patient is vegan or lacto-ovo-vegetarian.
  - Older adults over age 50 need vitamin B₁₂ 2.4 mcg/day, and need to ensure adequate intake of vitamin D and calcium.
  - Patients at risk for suboptimal vitamin D levels should consume vitamin D-fortified foods and/or supplements.
Neutraceuticals

- Foods that claim to have a medicinal effect on health
- Fiber
- Vitamins and minerals
- Fatty acids
- Plant sterols
- Pre-, pro- and symbiotics
Fiber

- Decreased constipation
- Reduced risk for coronary heart disease
  - 25 gm/day for cardiovascular health
- Better glucose control in diabetics
- Improved lipid levels
Vitamins

- Vitamin A
  - critical role in vision, bone growth, reproduction, immune function, cell division and differentiation
- Vitamin B₁ (thiamine)
  - Thiamine deficiency can lead to beriberi or Wernicke’s encephalopathy
  - Alcoholics at high risk
- Vitamin B₂ (riboflavin)
  - Deficiency may be seen in alcoholics, anorexic patients, and lactose intolerance
  - May decrease headaches and migraines
Vitamins (con’t)

- Vitamin B₃ (niacin)
  - Used to treat hyperlipidemia
- Vitamin B₆ (pyridoxine)
  - Vitamin B₆ deficiency may be drug induced
  - Pyridoxine given prophylactically to patients on isoniazid, cycloserine, or hydrazine to prevent peripheral neuropathy
- Vitamin B₁₂
  - Vitamin B₁₂ deficiency will lead to megaloblastic anemia
Vitamins (con’t)

- **Vitamin C (ascorbic acid)**
  - Humans do not have the ability to synthesize Vit C
  - Inadequate vitamin C intake may develop scurvy
  - Smokers have decreased Vit C levels (+ 35 mg/day)
  - Does not decrease incidence of URIs
  - Mixed results in decreasing cardiovascular disease and cancer

- **Vitamin D**
  - Critical to bone health
  - All infants, children and adults need 400 IU per day
Vitamins (con’t)

- Vitamin K
  - A critical component of blood clotting
    - found in many foods
    - synthesized by intestinal bacteria
  - Newborns need 0.5 mg to 1.0 mg, ideally within the first hour of life to prevent Vit K-deficiency bleeding
  - Vit K is used as an antidote to critically high INR in patients taking warfarin
Vitamins

Folate

- Critical to the production and maintenance of new cells.
- Found in foods such as green leafy vegetables, citrus fruits, and dried legumes
- Folic acid is the synthetic form of folate
- Folate deficiency occurs during pregnancy and with increased losses
- Folic acid supplementation is recommended for:
  - Childbearing age teens and women 400 mcg/day
  - Pregnant women 600 mcg/day
  - Lactating 500 mcg/day
Minerals

- Calcium
  - Required for muscle contraction, blood vessel health, bone health, and normal nerve conduction
  - Adolescent females have inadequate intake
  - Recommended amounts vary by age to prevent osteoporosis

- Iron
  - Needed for oxygen transport
  - Patients with iron deficiency will develop microcytic-hypochromic anemia
  - Adequate intake is determined by age
  - All infants should be assessed for adequate iron in diet
Fatty Acids

- Essential fatty acids
  - Must be consumed, body cannot make
  - alpha-linolenic acid (ALA) an omega-3 fatty acid
  - linoleic acid (LA) is an omega-6 fatty acid
  - Dietary sources of ALA are nuts, vegetable oils, and leafy green vegetables
  - LA is found in vegetable oils and meat
  - EPA and DHA are found in fish and organ meats
  - Omega 3 fatty acids are recommended for cardiovascular health
  - Fish oil might have antiarrhythmic effects
  - Children with autism or ADHD may respond to omega 3 supplements
  - Patients can consume supplement or eat fatty fish
Plant Sterols

- Found in all plant-based foods
- Similar in structure to cholesterol
- Plant sterols compete with cholesterol in the intestine, reducing the amount of cholesterol that is absorbed
- Intake of 2 g/day of plant sterols has an associated 6 to 10 percent reduction in LDL cholesterol
- Plant sterols are present in:
  - edible oils (corn oil and canola oil have the highest amount)
  - seeds and nuts
  - commercial food products available with added plant sterols
Pre-, Pro-, and Symbiotics

- Probiotics are nonpathogenic bacteria normally found in the intestinal microflora:
  - Most common of which are Lactobacillus acidophilus and the Bifidobacterium species
  - *Cochrane Review* of probiotic use in rotavirus-associated acute diarrhea in children found reduced diarrhea severity and duration by 1 to 3 days
  - May improve inflammatory bowel disease and necrotizing enterocolitis (NEC)