NUTRITION · STUDY GUIDE

Exam 6 Study Guide

This guide covers food safety and diet and chronic disease. Both chapters reward the same habit: ask what kind of evidence you are looking at and what number it really gives you. In food safety the numbers are temperatures and times, and they are exact. In chronic disease the numbers are risks, and the key move is telling relative from absolute and hazard from risk. Work one chapter at a time and finish each with its ten self-test items.

WHAT THIS GUIDE COVERS

- Chapter 11 · infection versus intoxication, the major pathogens and onset times, oral rehydration, the danger zone and two-hour rule, cooking and cooling temperatures, clean, separate, cook, chill, higher-risk groups and foods, and additives, residues, ADI and hazard versus risk.
- Chapter 12 · LDL and the replacement effect, sodium and potassium, type 2 diabetes and carbohydrate quality, the DPP, IARC groups and diet and cancer, alcohol, bone, calcium and vitamin D, and the Mediterranean, DASH and plant-based patterns.

CHAPTER 11

Food Safety

Read it in full: **Chapter 11 in the textbook**. Practice it in the lab: **The Danger Zone** and **Meet the Pathogens: Reading the Onset Clock**.

What to know

Foodborne illness comes in two kinds. In an **infection**, a living microbe survives the stomach and multiplies in you, so illness takes hours to days. In an **intoxication**, the microbe made a toxin in the food before it was eaten, so symptoms come fast. A **toxicoinfection** sits between: the organism is swallowed alive and makes toxin inside you. Onset time is the best single clue. Vomiting two hours after a meal points to a preformed toxin such as Staphylococcus aureus or emetic Bacillus cereus.

Norovirus causes about 58% of domestically acquired foodborne illness from known agents. As few as about 18 particles can infect, it survives on surfaces, and alcohol gel is unreliable against it. Among bacteria, nontyphoidal **Salmonella** causes the most hospitalizations and deaths. **Campylobacter** is the most common bacterial cause of diarrhea, from undercooked poultry and raw milk, and is sometimes followed by Guillain-Barré syndrome. **STEC** (E. coli O157:H7) causes bloody diarrhea, often without fever, and in about 5 to 10% of cases, mostly children under five, hemolytic uremic syndrome.

Listeria grows at refrigerator temperature, tolerates salt, can incubate for weeks, and in invasive form kills about one in five. **Clostridium botulinum** makes a neurotoxin in badly home-canned low-acid foods, causing descending paralysis in an alert person without fever. Honey is not given before 12 months because of infant botulism. Staph toxin is heat-stable, so reheating does not help. Scombroid is a histamine reaction to temperature-abused fish, not an infection.

Most cases in healthy adults pass on their own; the real danger is fluid and electrolyte loss. Oral rehydration solution pairs sodium (75 mmol/L) with glucose (75 mmol/L), about 245 mOsm/L total, because the two are absorbed together and pull water with them. Plain water does not restore sodium. Bloody stools, high fever, nerve symptoms, dehydration or illness in a high-risk person need medical care.

Bacteria can double about every 20 minutes. The **danger zone** is 40°F to 140°F (4°C to 60°C) by USDA convention and 41°F to 135°F (5°C to 57°C) in the FDA Food Code. Perishable food should spend no more than **two hours** in it, counted cumulatively, or one hour above 90°F (32°C).

Cooking is the kill step, but only a thermometer tells you it happened; color and browning do not. Poultry of all kinds 165°F (74°C). Ground meats 160°F (71°C). Whole cuts 145°F (63°C) plus a 3 minute rest. Fish 145°F. Egg dishes 160°F. Leftovers reheated to 165°F. Hot holding at or above 135°F and cold holding at or below 41°F maintain safety but do not create it. Check a thermometer in ice water: it should read 32°F.

Cooling is where kitchens fail. The Food Code uses **two-stage cooling**: 135°F to 70°F within 2 hours, then 70°F to 41°F within 4 more, 6 hours in all. Use shallow pans about 2 inches deep, ice baths and ice paddles. Thaw only in the refrigerator, in cold water, in the microwave with cooking

right after, or as part of cooking. Keep the fridge at or below 40°F and the freezer at 0°F. Use leftovers in 3 to 4 days. Freezing suspends most bacteria rather than killing them.

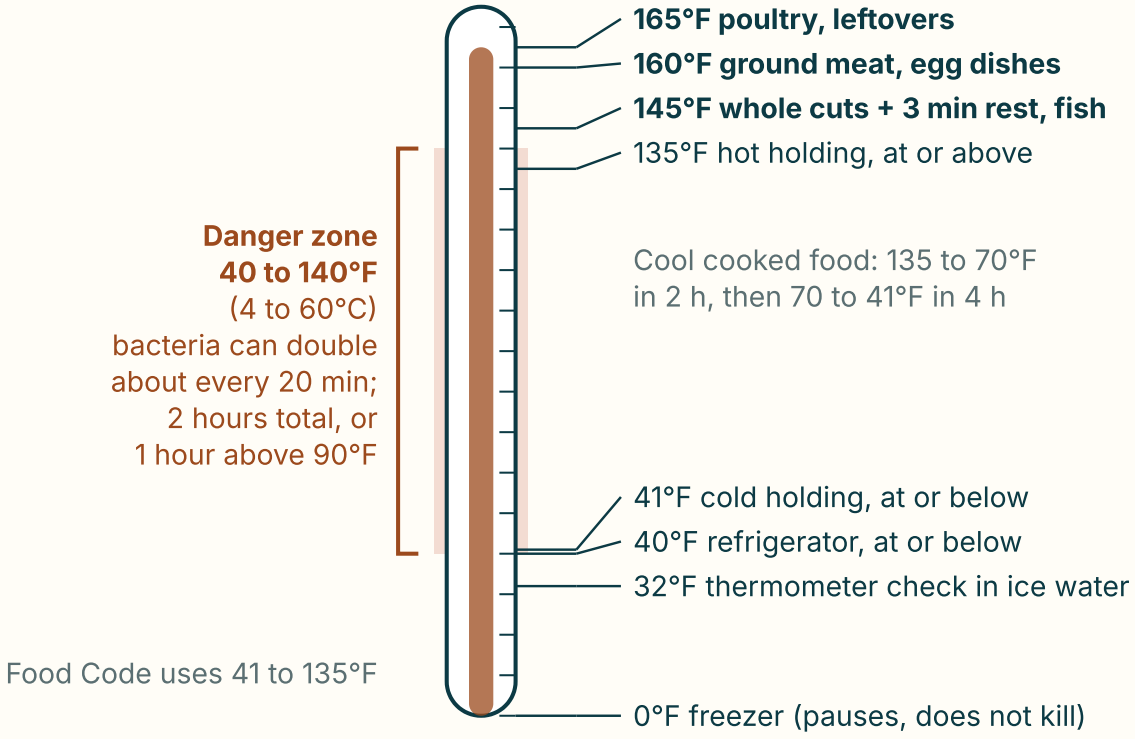
The four core practices are **clean, separate, cook, chill**. Handwashing is mechanical: soap, 20 seconds of friction, running water and a clean towel. Sanitizer at 60% alcohol or more helps but fails against norovirus, spores and soiled hands. Use separate boards for raw animal foods, store raw meat sealed on the bottom shelf, and never reuse a raw-meat plate. Do not wash raw poultry, which splashes bacteria. Do wash produce under running water only, including melon rinds, and never with soap or bleach.

Four groups face more risk from the same meal, for physical reasons: **pregnancy** (about 10 times the listeriosis risk; Listeria crosses the placenta; Toxoplasma), **children under five** (immature immunity, little reserve, HUS risk), **adults 65 and older** (aging immunity, less stomach acid, slower gut) and the **immunocompromised**. People on acid-suppressing drugs and people with liver disease or iron overload (Vibrio vulnificus in raw oysters) are also at risk. High-risk foods lack a kill step: raw animal foods, raw sprouts, precut melon, raw flour and refrigerated ready-to-eat foods. Pasteurization (161°F for 15 seconds) removes pathogens without meaningfully lowering milk's nutrition. These are situational precautions, not "bad foods."

FDA oversees most foods, USDA-FSIS covers meat, poultry and egg products, and EPA sets pesticide tolerances. FSMA (2011) moved the FDA toward prevention, and HACCP plans control hazards at critical points. Additives are approved or are GRAS. The Delaney Clause led to revoking Red No. 3 in food in 2025. The **ADI** is the animal NOAEL divided by a safety factor of 100 (10 for animal to human, 10 for human variation). Aspartame's ADI is 50 mg/kg (FDA) or 40 mg/kg (JECFA). **Hazard** asks whether something can cause harm; **risk** asks whether it will at real doses. IARC classifies hazards. Over 99% of residue samples are at or below tolerance, and the strong evidence for eating more produce outweighs speculative residue worries.

LOCK THESE IN

- Fast onset with vomiting means a preformed toxin. Days later means an organism that multiplied.
- Norovirus causes the most illness; Salmonella the most bacterial hospitalizations and deaths.
- Danger zone 40 to 140°F (USDA) or 41 to 135°F (Food Code). Two hours cumulative; one hour above 90°F.
- Poultry 165, ground meat 160, whole cuts 145 plus 3 min rest, leftovers 165 (°F).
- Cool 135 to 70°F in 2 hours, then 70 to 41°F in 4 more.
- Do not wash raw poultry. Wash produce under running water only.
- Higher risk: pregnancy, under five, 65 and older, immunocompromised. Listeria grows in the fridge.
- ADI = NOAEL ÷ 100. Hazard is not risk; relative is not absolute.



Keep food out of the zone. Cooking is the kill step, but only a thermometer confirms it. Holding keeps safety; it does not create it.

Safe temperatures and times

Item	Value	Note
Danger zone, USDA	40°F to 140°F (4°C to 60°C)	Home convention
Danger zone, FDA Food Code	41°F to 135°F (5°C to 57°C)	Retail and food service
Two-hour rule	No more than 2 h total in the zone	1 h above 90°F (32°C)
Poultry, all forms	165°F (74°C)	Includes ground poultry and stuffing
Ground meats	160°F (71°C)	Grinding spreads surface bacteria inside
Whole cuts	145°F (63°C) plus 3 min rest	Steaks, chops, roasts
Fish and shellfish	145°F (63°C)	Or opaque and flaking
Egg dishes	160°F (71°C)	Plain eggs cooked firm
Leftovers	165°F (74°C)	Steaming throughout
Holding	Hot at or above 135°F; cold at or below 41°F	Holding keeps safety; it does not create it
Cooling	135 to 70°F in 2 h; 70 to 41°F in 4 h	6 h total
Storage	Fridge at or below 40°F; freezer 0°F	Leftovers 3 to 4 days
Pasteurization	161°F (72°C) for 15 s	High-temperature short-time
Thermometer check	Ice water reads 32°F (0°C)	Calibrate now and then

Pathogens by onset time

Agent	Typical onset	Hallmark	Classic sources
Staphylococcus aureus	30 min to 8 h	Abrupt vomiting; heat-stable toxin	Hand-handled foods held warm
Bacillus cereus (emetic)	30 min to 6 h	Vomiting	Cooked rice held at room temperature
Clostridium perfringens	6 to 24 h	Cramps, diarrhea; over in a day	Big batches of meat, gravy cooled slowly
Norovirus	12 to 48 h	Vomiting and diarrhea, 1 to 3 days	Sick food handlers, raw shellfish, greens
Salmonella	12 to 72 h	Diarrhea, fever, cramps	Poultry, eggs, produce, raw flour
Campylobacter	2 to 5 days	Diarrhea, fever; rare Guillain-Barré	Undercooked poultry, raw milk
STEC O157:H7	3 to 4 days	Bloody diarrhea, often no fever; HUS	Undercooked ground beef, raw greens
Listeria	1 day to 10 weeks	Invasive in high-risk groups; grows at 4°C	Deli meats, raw-milk soft cheese, sprouts
Clostridium botulinum	12 to 72 h	Descending paralysis, no fever	Home-canned low-acid foods; honey in infants
Hepatitis A	15 to 50 days	Fatigue, jaundice; vaccine-preventable	Sick food handlers, shellfish, frozen berries

Worked examples

WORKED EXAMPLE 1 · READING THE CLOCK

Twelve people eat a potato salad at noon. At about 2:30 pm several begin vomiting hard. No one has a fever. What kind of illness is this, and would reheating the salad have helped?

STEP 1 · MEASURE THE ONSET

Noon to 2:30 pm is 2.5 hours.

STEP 2 · APPLY THE RULE

Under about 6 hours with vomiting in front means a toxin already in the food. No organism multiplies in a person that fast.

STEP 3 · NAME THE LIKELY AGENT

A hand-handled salad held warm fits **Staphylococcus aureus** (onset 30 min to 8 h).

STEP 4 · REHEATING

No. Staph enterotoxin is heat-stable. Only keeping the food cold would have prevented it.

WORKED EXAMPLE 2 · A HOT-DAY PICNIC

The air is 92°F. Chicken salad rides 30 minutes in the car, then sits 45 minutes on the picnic table. Should it be eaten?

STEP 1 · FIND THE LIMIT

Above 90°F the two-hour budget drops to **one hour**.

STEP 2 · ADD THE TIME

30 + 45 = 75 minutes, counted together.

STEP 3 · COMPARE

75 minutes is over the 60 minute limit. **Throw it out**, and never taste to check.

PREVENT IT

A cooler with ice keeps the salad at or below 40°F, so the clock never starts.

WORKED EXAMPLE 3 · DID THE STOCKPOT COOL SAFELY?

A cook takes chili off the stove at 135°F at 6:00 pm. At 8:00 pm the center reads 80°F. At 11:30 pm it reads 41°F. Did it pass the two-stage rule?

STEP 1 · STAGE 1 RULE

135°F to 70°F within 2 hours, so by 8:00 pm.

STEP 2 · CHECK STAGE 1

At 8:00 pm it is 80°F, still above 70°F. **Stage 1 failed.**

STEP 3 · STAGE 2

Reaching 41°F by 11:30 pm is within 6 hours total, but that cannot repair the failed first stage.

THE FIX

Split hot food into shallow pans about 2 inches deep, use an ice bath and stir with an ice paddle so the center cools fast.

WORKED EXAMPLE 4 · USING AN ADI

Aspartame's ADI is 50 mg/kg/day (FDA) or 40 mg/kg/day (JECFA). What does each allow for a 60 kg adult, and where does an ADI come from?

STEP 1 · FDA

50 × 60 = **3,000 mg/day**.

STEP 2 · JECFA

40 × 60 = **2,400 mg/day**.

STEP 3 · THE ORIGIN

An ADI is the highest dose with no observed adverse effect in animals (NOAEL) divided by 100: 10 for animal to human differences and 10 for human variation.

HAZARD VERSUS RISK

IARC put aspartame in Group 2B, a hazard label. JECFA, judging risk at real doses, kept its ADI unchanged. The two statements answer different questions.

TRAPS PEOPLE FALL INTO

- **Reheating to fix food left out too long.** Staph toxin survives heat. No later step repairs time in the danger zone.
- **Judging doneness by color.** Browning is surface chemistry. Use a thermometer.
- **Counting only the longest stretch.** The two-hour rule adds every period in the zone.
- **Thinking the fridge stops all bacteria.** It slows most, but Listeria grows at 4°C.
- **Washing raw chicken.** It splashes bacteria around the sink. Cooking is what kills them.
- **Relying on hand gel for norovirus.** Its tough capsid resists alcohol. Use soap and water.
- **Reading IARC Group 1 as "as dangerous as tobacco."** The group shows certainty of a hazard, not its size.
- **Calling soft cheese or deli meat a bad food.** They are situational risks for specific groups, not moral categories.

Chapter 11 self-test · ten items

1. A family vomits four hours after a meal of cooked rice that sat out all afternoon. Which agent fits best?

A. Campylobacter jejuni
B. Hepatitis A virus (HAV)
C. E. coli O157:H7 (STEC)
D. Bacillus cereus (emetic)

D. Bacillus cereus (emetic) Emetic B. cereus makes a toxin in rice held at room temperature, with onset of 30 minutes to 6 hours. The others take days or weeks.

2. Which organism is the leading cause of foodborne illness from known agents?

A. Salmonella
B. Campylobacter
C. Norovirus
D. Listeria

C. Norovirus Norovirus causes about 58% of domestically acquired foodborne illness from known agents. Salmonella leads bacterial hospitalizations and deaths.

3. A 3-year-old has bloody diarrhea without fever after a party with hamburgers. What complication is most feared?

A. Jaundice from liver injury
B. Hemolytic uremic syndrome
C. Descending flaccid paralysis
D. Guillain-Barré syndrome

B. Hemolytic uremic syndrome STEC causes HUS in about 5 to 10% of cases, mostly in children under five.

4. Why does oral rehydration solution contain both sodium and glucose?

A. They are absorbed together and pull water in
B. Glucose replaces the energy lost in stool
C. Glucose kills the bacteria in the gut
D. Sodium blocks the toxin from binding

A. They are absorbed together and pull water in A shared transporter absorbs glucose with sodium, and water follows. Plain water does not restore sodium.

5. What safe minimum internal temperature applies to a ground beef burger?

A. 145°F (63°C)
B. 160°F (71°C)
C. 175°F (79°C)
D. 135°F (57°C)

B. 160°F (71°C) Grinding spreads surface bacteria through the meat, so ground meats need 160°F. Whole cuts need 145°F with a rest.

6. How many total hours does the Food Code allow to cool food from 135°F to 41°F?

A. 8 hours, with the first 4 to reach 70°F
B. 4 hours, with the first 1 to reach 70°F
C. 6 hours, with the first 2 to reach 70°F
D. 2 hours, with all of it to reach 41°F

C. 6 hours, with the first 2 to reach 70°F Two-stage cooling: 135 to 70°F in 2 hours, then 70 to 41°F in 4 more.

7. Which practice does the chapter advise AGAINST?

A. Rinsing raw chicken in the sink
B. Washing melon rinds before cutting
C. Storing raw meat on the bottom shelf
D. Scrubbing firm produce with a brush

A. Rinsing raw chicken in the sink Rinsing raw poultry spreads bacteria onto the sink and nearby surfaces. Cooking to 165°F is what kills them.

8. Why is a pregnant person advised to heat deli meat until steaming?

A. Deli meat loses most of its iron when served cold
B. Cold deli meat holds extra methylmercury from fish
C. Heating removes all the nitrite from cured meats
D. Listeria risk is about 10 times higher in pregnancy

D. Listeria risk is about 10 times higher in pregnancy Pregnancy shifts cell-mediated immunity, and Listeria can cross the placenta. Listeria also grows at refrigerator temperature.

9. An ADI is set from the animal NOAEL divided by what factor?

A. 1,000
B. 100
C. 10
D. 50

B. 100 A factor of 10 covers animal to human differences, and another 10 covers variation among humans.

10. What does an IARC Group 1 classification tell you?

A. Any amount at all is certain to cause cancer
B. It causes as much cancer as tobacco does
C. Its absolute risk is above 10 percent
D. There is sufficient evidence it can cause cancer

D. There is sufficient evidence it can cause cancer IARC classifies hazards by certainty of evidence. It does not measure how much cancer an agent causes.

CHAPTER 12

Diet and Chronic Disease

Read it in full: **Chapter 12 in the textbook**. Practice it in the lab: **Diet & Heart Disease** and **Mediterranean, DASH & Plant-Based: Compare the Patterns**.

What to know

Lipoproteins carry fat through the blood. Chylomicrons carry dietary fat from the gut, VLDL exports liver triglyceride, LDL delivers cholesterol to tissues, and HDL returns it to the liver. **LDL is causal** in atherosclerosis: animal work, human genetics and many drug trials agree. Low HDL predicts risk, but raising HDL has not reduced events, so a marker is not always a cause.

Saturated fat raises LDL compared with unsaturated fat. Industrial trans fat raises LDL and lowers HDL, and lost its GRAS status in the US in 2015. Monounsaturated and polyunsaturated fats lower LDL when they replace saturated fat. The key is **substitution**: replacing saturated fat with polyunsaturated fat reduces events; replacing it with refined carbohydrate does not. Dietary cholesterol has a modest, variable effect, so the 300 mg cap was dropped in 2015. Fish in the diet lowers triglycerides (moderate evidence), while omega-3 supplements for the general population show weak benefit.

High blood pressure is the largest single contributor to cardiovascular death worldwide. Cutting sodium lowers it in a dose-dependent way, more in people with hypertension, older adults and

salt-sensitive people. Adult sodium AI is 1,500 mg and the CDRR is 2,300 mg, against an average near 3,400 mg, about 70% from packaged and restaurant food. Potassium AI is 3,400 mg for men and 2,600 mg for women (revised down from 4,700 in 2019). Viscous fibers such as oat beta-glucan and psyllium add a small LDL drop.

Type 2 diabetes combines **insulin resistance** with beta cells that can no longer keep up. Prediabetes is fasting glucose 100 to 125 mg/dL or HbA1c 5.7 to 6.4%. Diabetes is fasting glucose 126 or higher or HbA1c 6.5% or higher. Visceral fat is a strong predictor, but how much a person carries is shaped by genetics, medicines, sleep, stress, food access and income. Risk is higher at lower BMI in several populations, notably South Asian.

The carbohydrate RDA is 130 g (175 pregnancy, 210 lactation) and the AMDR is 45 to 65%. **Quality** tracks diabetes risk more than quantity: whole grains and legumes go with lower risk, and sugar-sweetened beverages with higher risk, even after weight adjustment. Glycemic index alone is mixed evidence. Low-carbohydrate patterns improve HbA1c at 3 to 6 months, but the edge narrows by 12 months. The **Diabetes Prevention Program** cut new diabetes 58% with an intensive supported program (about 7% weight loss and 150 minutes a week of activity) versus 31% with metformin. Activity improves insulin sensitivity even without weight change.

Most diet and cancer evidence is observational and is graded: convincing, probable, limited-suggestive, insufficient. Excess body fatness is judged to raise risk of at least a dozen cancers. Fiber-rich whole foods are linked to lower colorectal cancer risk, but short fiber-supplement trials were null. Fiber AI: 38 g men and 25 g women (19 to 50), 30 and 21 g after 50.

IARC puts **processed meat** in Group 1 and red meat in Group 2A, mostly for colorectal cancer. Group 1 means high certainty, not high danger: about 50 g/day of processed meat goes with about 18% higher relative risk, a small absolute increase. **Alcohol** is also Group 1. It is converted to acetaldehyde, which damages DNA; people with a low-activity ALDH2 variant flush and have higher esophageal cancer risk. Alcohol is causal for cancers of the mouth, pharynx, larynx, esophagus, liver, colorectum and female breast, with no safe threshold identified. The old J-curve for heart benefit has weakened. Beta-carotene supplements raised lung cancer in smokers.

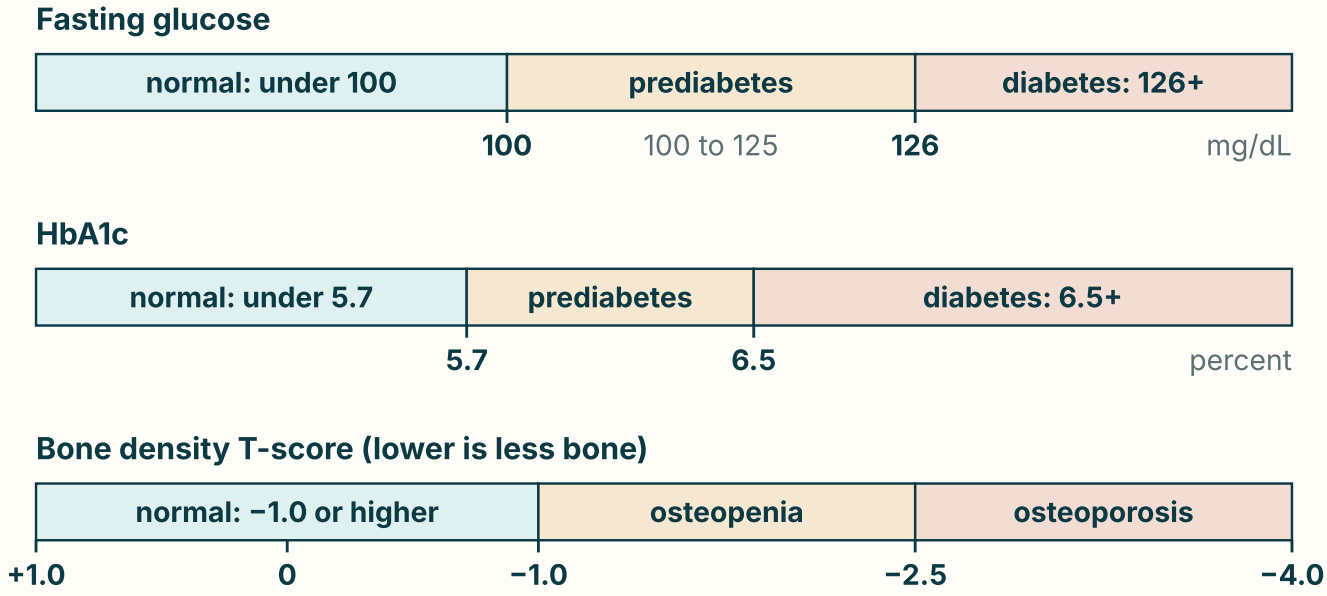
Bone is rebuilt constantly. Peak bone mass is reached by the late twenties, then loss begins, quickly for some years after menopause. **Osteoporosis** is a T-score of −2.5 or lower (osteopenia −1.0 to −2.5): less bone, normally mineralized. **Osteomalacia** is enough matrix but too little mineral, from low calcium or vitamin D. Calcium RDA: 1,300 mg (9 to 18), 1,000 mg (men 19 to 70, women 19 to 50), 1,200 mg (women 51+, men 71+). UL 2,500 mg (19 to 50), 2,000 mg (51+). Vitamin D: 600 IU (15 µg) ages 1 to 70, 800 IU (20 µg) after; UL 4,000 IU.

About 30% of milk's calcium is absorbed. Low-oxalate greens such as kale and bok choy do well, while spinach's oxalate blocks its calcium. Smaller doses spread through the day absorb better. Adequate protein supports bone, and the acid-ash idea did not survive testing. Very high sodium raises urinary calcium a little.

Single nutrients in pills keep failing where whole diets succeed: beta-carotene, vitamin E, antioxidants and fiber pills. Reasons: the food matrix, nutrient interactions, substitution (every food replaces another) and nutrients that travel together. **Mediterranean**: PREDIMED cut major cardiovascular events about 30% in high-risk adults (retracted and republished in 2018 with similar results). **DASH**: a controlled feeding trial that lowered systolic pressure about 5.5 mmHg overall and about 11 mmHg in people with hypertension, with sodium reduction adding to it. **Plant-based**: lower diabetes and cardiovascular deaths in cohorts, with confounding possible and quality varying, and B12 needing a plan. The patterns share vegetables, fruit, legumes, whole grains, nuts and unsaturated fat, and work in any cuisine. Adherence, cost and culture matter more than picking the "best" one.

LOCK THESE IN

- LDL is causal. HDL is a marker; raising it has not cut events.
- Replace saturated fat with polyunsaturated fat, not refined carbohydrate.
- Sodium AI 1,500 mg, CDRR 2,300 mg, US average about 3,400 mg, about 70% from packaged and restaurant food.
- Prediabetes: fasting 100 to 125 mg/dL or HbA1c 5.7 to 6.4%. Diabetes: 126+ or 6.5%+.
- Carbohydrate quality beats quantity for diabetes risk. DPP cut new diabetes 58%.
- IARC Group 1 means certainty, not size. Processed meat: about 18% relative risk per 50 g/day.
- Calcium 1,000 / 1,200 / 1,300 mg by group. Vitamin D 600 IU to age 70, 800 IU after.
- DASH lowered systolic pressure about 5.5 mmHg (about 11 if hypertensive). PREDIMED about 30% fewer events.



Osteoporosis is less bone, normally mineralized. Osteomalacia is too little mineral.

Know the cut points. The same three bands repeat: normal, an in-between warning zone, and disease.

Chronic disease numbers

Item	Value	Note
Sodium	AI 1,500 mg; CDRR 2,300 mg	US average about 3,400 mg
Potassium	AI 3,400 mg men; 2,600 mg women	Revised from 4,700 mg in 2019
Prediabetes	Fasting glucose 100 to 125 mg/dL; HbA1c 5.7 to 6.4%	Diabetes: 126+ mg/dL or 6.5%+
Carbohydrate	RDA 130 g; 175 pregnancy; 210 lactation	AMDR 45 to 65%
DPP	About 7% weight loss plus 150 min/week	58% fewer cases; metformin 31%
Processed meat	About 18% higher relative risk per 50 g/day	Colorectal cancer; IARC Group 1
Calcium RDA	1,300 mg (9 to 18); 1,000 mg (men 19 to 70, women 19 to 50); 1,200 mg (women 51+, men 71+)	UL 2,500 mg to 50, 2,000 mg after
Vitamin D RDA	600 IU (15 µg) to 70; 800 IU (20 µg) after	UL 4,000 IU (100 µg)
Bone density	Osteoporosis T-score −2.5 or lower	Osteopenia −1.0 to −2.5
Milk calcium	About 300 mg per cup; about 30% absorbed	Spinach calcium is poorly absorbed
Fiber AI	38 g men, 25 g women (19 to 50); 30 and 21 g after 50	About 14 g per 1,000 kcal
DASH	About −5.5 mmHg systolic; about −11 if hypertensive	Controlled feeding trial
PREDIMED	About 30% fewer major cardiovascular events	High-risk adults

Fats and LDL

Fat type	Typical sources	Effect on LDL	Evidence
Saturated	Fatty meat, butter, cheese, coconut and palm oil	Raises LDL vs unsaturated fat	Strong
Industrial trans	Partially hydrogenated oil	Raises LDL, lowers HDL	Strong; no safe intake identified
Monounsaturated	Olive oil, canola, avocado, most nuts	Lowers LDL when replacing saturated	Strong
Polyunsaturated (n−6)	Soybean, corn, sunflower oil, seeds	Lowers LDL; fewer events on substitution	Strong
Long-chain n−3	Salmon, sardines, mackerel, herring	Lowers triglycerides; little LDL effect	Moderate for fish; weak for supplements

Worked examples

WORKED EXAMPLE 1 · RELATIVE VERSUS ABSOLUTE RISK

Processed meat at about 50 g/day goes with about an 18% higher relative risk of colorectal cancer. If a lifetime baseline risk is 4.5%, what is the new absolute risk and the change?

STEP 1 · APPLY THE RELATIVE INCREASE

4.5% × 1.18 = **5.31%**.

STEP 2 · FIND THE CHANGE

5.31 − 4.5 = **0.81 percentage points**, well under one point.

STEP 3 · READ IT

Real and worth knowing, but small. "18% higher" and "less than one point higher" describe the same finding.

HAZARD VERSUS SIZE

Group 1 status says the evidence is certain, not that the effect is large. Tobacco and processed meat share the group but differ hugely in size.

WORKED EXAMPLE 2 · CLASSIFYING GLUCOSE RESULTS

Three adults have these results. Ana: fasting glucose 92 mg/dL. Ben: fasting glucose 112 mg/dL and HbA1c 6.0%. Chloe: fasting glucose 128 mg/dL. Classify each by the chapter's cut points.

STEP 1 · ANA

92 is below 100, so **normal** fasting glucose.

STEP 2 · BEN

112 falls in 100 to 125, and 6.0% falls in 5.7 to 6.4%. Both say **prediabetes**.

STEP 3 · CHLOE

128 is 126 or higher, which is in the **diabetes** range (a clinician confirms a diagnosis).

WHAT HELPS BEN

The DPP showed an intensive supported lifestyle program cut progression 58%. Activity improves insulin sensitivity even without weight change.

WORKED EXAMPLE 3 · SODIUM ARITHMETIC

An adult eats the US average of about 3,400 mg of sodium a day. How much must intake fall to reach the CDRR, and about how much of today's sodium came from packaged and restaurant food?

STEP 1 · GAP

3,400 − 2,300 = **1,100 mg**.

STEP 2 · AS A SHARE

1,100 ÷ 3,400 = 0.32, about a 32% cut.

STEP 3 · WHERE IT COMES FROM

About 70% arrives already in food: 3,400 × 0.70 = **2,380 mg**.

WHY THIS MATTERS

Most sodium is a property of the food supply, so reformulation and label reading move intake more than the salt shaker.

WORKED EXAMPLE 4 · CALCIUM FOR A WOMAN OVER 50

Helen is 55. She drinks 2 cups of milk a day and is thinking about a 1,000 mg calcium supplement on top of a diet that already meets her RDA. Work out her numbers.

STEP 1 · HER RDA

Women 51+: **1,200 mg/day**.

STEP 2 · FROM MILK

2 cups × about 300 mg = 600 mg, so 1,200 − 600 = 600 mg must come from other foods.

STEP 3 · ABSORPTION

About 30% of milk calcium is absorbed: 600 × 0.30 = 180 mg. Spreading calcium across the day helps absorption.

STEP 4 · THE SUPPLEMENT

1,200 from food + 1,000 = 2,200 mg, which is over her UL of **2,000 mg** (ages 51+). Going over is linked to kidney stones and high blood calcium.

TRAPS PEOPLE FALL INTO

- **Judging a fat without its replacement.** Ask what replaced the saturated fat. Refined carbohydrate does not help.
- **Treating HDL as a target.** Raising HDL with drugs did not cut events.
- **Saying "sugar causes diabetes."** Quality matters: sugar-sweetened drinks track with risk; whole grains and legumes with lower risk.
- **Reading IARC Group 1 as equal danger.** Group 1 is about certainty. Effect sizes differ enormously.
- **Expecting a fiber pill to match fiber-rich food.** Short supplement trials were null; whole foods over decades are what the cohorts show.
- **Mixing up osteoporosis and osteomalacia.** Osteoporosis is less bone; osteomalacia is poorly mineralized bone.
- **Counting spinach as a calcium source.** Oxalate binds its calcium. Kale and bok choy absorb better.
- **Calling one pattern the only right diet.** Mediterranean, DASH and plant-based share base foods; adherence and fit matter most.

Chapter 12 self-test · ten items

1. Which kind of evidence most strongly shows that LDL causes atherosclerosis?

A. A single small trial of egg-free diets
B. Animal feeding studies taken on their own
C. One large cohort of adults with low HDL levels
D. Genetics, cohorts and drug trials all agree

D. Genetics, cohorts and drug trials all agree People with lifelong low LDL have lifelong low risk, and many trials that lowered LDL lowered heart attacks.

2. In trials, replacing saturated fat with which nutrient reduced cardiovascular events?

A. Industrial trans fat
B. Polyunsaturated fat
C. Added sugars
D. Refined carbohydrate

B. Polyunsaturated fat The replacement effect: swapping toward polyunsaturated fat lowers LDL and events. Refined carbohydrate does not help.

3. Why was the 300 mg/day dietary cholesterol cap dropped from US guidance in 2015?

A. Eggs were shown to prevent heart disease
B. The body cannot absorb dietary cholesterol
C. Its effect on blood LDL is modest and variable
D. Cholesterol was found to raise HDL only

C. Its effect on blood LDL is modest and variable For most people, dietary cholesterol changes blood LDL only modestly, partly because the liver adjusts its own production.

4. A fasting glucose of 118 mg/dL falls into which category?

A. Prediabetes
B. Normal
C. Diabetes
D. Hypoglycemia

A. Prediabetes Prediabetes is a fasting glucose of 100 to 125 mg/dL. Diabetes starts at 126.

5. In the Diabetes Prevention Program, how did the lifestyle arm compare with metformin?

A. Neither arm cut new diabetes measurably
B. Both arms cut new diabetes by about 45%
C. It cut new diabetes by 58% versus 31%
D. It cut new diabetes by 31% versus 58%

C. It cut new diabetes by 58% versus 31% The intensive supported lifestyle program reduced new cases by 58%, metformin by 31%.

6. A headline says bacon is "as dangerous as cigarettes" because both are IARC Group 1. What is wrong with it?

A. Bacon is only in Group 2B, not in Group 1
B. Group 1 rates certainty of a hazard, not its size
C. Group 1 means a food is safe in moderation
D. Cigarettes are not classified by IARC at all

B. Group 1 rates certainty of a hazard, not its size Processed meat and tobacco share the group, but their absolute effects on risk differ enormously.

7. Which mechanism links alcohol most directly to cancer?

A. Alcohol raises HDL far above a safe level
B. Alcohol turns heme iron into nitrite compounds
C. Alcohol blocks the absorption of dietary fiber
D. Acetaldehyde, its breakdown product, harms DNA

D. Acetaldehyde, its breakdown product, harms DNA Ethanol is converted to acetaldehyde, a carcinogen. People with a low-activity ALDH2 variant clear it slowly.

8. Walter, 75, asks how much calcium he should aim for each day. What is the RDA for his group?

A. 1,200 mg/day
B. 800 mg/day
C. 1,300 mg/day
D. 1,000 mg/day

A. 1,200 mg/day Men 71 and older and women 51 and older have an RDA of 1,200 mg. Men 19 to 70 are at 1,000 mg.

9. Bone biopsy shows plenty of bone matrix that is poorly mineralized, in an adult low in vitamin D. What is this?

A. Osteoporosis
B. Osteopenia
C. Osteomalacia
D. Sarcopenia

C. Osteomalacia Osteomalacia is under-mineralized bone in adults. Osteoporosis is less bone that is normally mineralized, osteopenia is milder low bone density, and sarcopenia is muscle loss.

10. Which statement about the DASH trial is correct?

A. It held weight steady and still lowered blood pressure
B. It worked only when sodium was left unchanged
C. It cut events but did not change blood pressure
D. It was an observational study of vegetarians

A. It held weight steady and still lowered blood pressure DASH provided all food with weight held constant and lowered systolic pressure about 5.5 mmHg, and sodium reduction added to the effect.

ONE PAGE

Cram sheet

Everything from chapters 11 and 12 in one place. Cover the right column and see if you can rebuild each row.

Food safety numbers

Item	Value	Note
Danger zone	40 to 140°F (USDA); 41 to 135°F (Food Code)	4 to 60°C; 5 to 57°C
Two-hour rule	2 h cumulative; 1 h above 90°F	When in doubt, throw it out
Cook to	Poultry 165; ground meat 160; whole cuts 145 plus 3 min; fish 145; eggs 160; leftovers 165	°F
Cooling	135 to 70°F in 2 h; 70 to 41°F in 4 h	Shallow pans, ice bath
Storage	Fridge 40°F or below; freezer 0°F	Leftovers 3 to 4 days
ORS	Sodium 75 and glucose 75 mmol/L; about 245 mOsm/L	Absorbed together
Handwashing	20 s with soap and running water	Gel at 60%+ fails on norovirus
ADI	NOAEL ÷ 100	Aspartame 50 (FDA) or 40 (JECFA) mg/kg

Chronic disease numbers

Item	Value	Note
Sodium	AI 1,500 mg; CDRR 2,300 mg	Average 3,400 mg; 70% from packaged and restaurant food
Potassium	AI 3,400 mg men; 2,600 mg women	Most people fall short
Glucose	Prediabetes 100 to 125 mg/dL, HbA1c 5.7 to 6.4%	Diabetes 126+ or 6.5%+
DPP	58% fewer cases (metformin 31%)	About 7% loss plus 150 min/week
Processed meat	About 18% relative risk per 50 g/day	Group 1; red meat Group 2A
Calcium	1,000 / 1,200 / 1,300 mg	UL 2,500 then 2,000 mg
Vitamin D	600 IU to 70; 800 IU after	UL 4,000 IU
DASH and PREDIMED	About −5.5 mmHg systolic; about 30% fewer events	Trial evidence

Rules that are not equations

Topic	The rule
Onset	Under 6 h with vomiting means preformed toxin; days later means infection; weeks later can be hepatitis A or Listeria.
Four practices	Clean, separate, cook, chill.
Higher risk	Pregnancy, under five, 65 and older, immunocompromised; plus acid suppression and liver disease.
Evidence	Hazard is not risk; relative is not absolute; look for the grade and the design.
Fat swaps	What replaces saturated fat decides the result.
Bone	Osteoporosis = less bone; osteomalacia = poorly mineralized bone.
Patterns	Shared base foods; adherence, cost and culture beat optimization.

Dr. Garg Learning · CC BY-SA 4.0