Tishk International University
Faculty of Applied Science
Nutrition and Dietetics Department
Nutrition for Adolescents and the Elderly– 2nd Grade

Adolescence – Growth & Development

Lecture: 3rd Lec

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Learning Outcome:

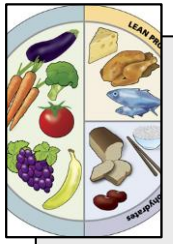
Explain the nutritional, physical, and developmental needs of adolescents

Identify common nutritional deficiencies and health challenges

Apply healthy eating guidelines and practical meal-planning principles

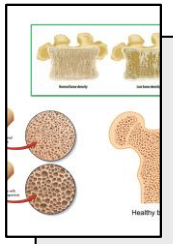
What is Adolescence?

- Adolescence is the transitional period between childhood and adulthood, typically spanning ages 11 to 21.
- This stage represents one of the most nutritionally vulnerable periods in the human lifespan, characterized by rapid physical, cognitive, and emotional development.



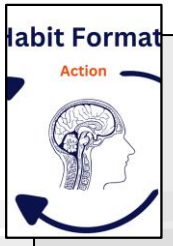
Why Nutrition Matters Now

Second Growth Window: After infancy, adolescence is the most intense period of growth and development



Bone Mass Accumulation: More than 50% of lifetime bone mass is built during built during teenage years

Opportunity for Catch-Up: Nutritional deficiencies from childhood can be addressed during this period



Habit Formation: Healthy eating patterns established now often persist into adulthood

WHY ADOLESCENT NUTRITION IS NOT JUST A PERSONAL OR FAMILY ISSUE, BUT A GLOBAL PUBLIC HEALTH CONCERN

1. Adolescents face unique nutritional risks

- Their bodies are growing rapidly
- Their nutrient needs increase significantly
- Many adolescents worldwide are not meeting those needs

2. WHO data shows large-scale deficiencies

- More than half of children under five are nutrient deficient
- Over two-thirds of non-pregnant women of reproductive age are also deficient in at least one key micronutrient
- This reflects a global pattern of poor nutrient intake, especially in low- and middle-income countries.

3. Why this matters for adolescents

- Because many people enter adolescence already nutrient deficient, this stage becomes even more critical. If deficiencies continue:
- Growth may slow
- Cognitive development can be impacted
- Long-term health risks increase (e.g., anemia, poor bone health)

Growth Spurt Timeline

Girls

Ages 10–14 (Peak: 11–12.5 years)

Height gain: Up to 9 cm/year at peak velocity

Boys

Ages 12–16 (Peak: 13–14 years)

Height gain: >10 cm/year at peak velocity

Timing Variations & Implications

- **Early/Late Development:**

Can cause emotional stress and peer pressure

- **Genetic & Environmental Factors:**

Nutrition, health, and living conditions influence timing

- **Medical Evaluation:**

Needed if puberty occurs before age 8 (girls) or 9 (boys)

Sexual Maturation (Tanner Staging)

Healthcare professionals use Tanner staging to track pubertal development.

Girls:

- Breast budding (first sign)
- Growth spurt initiation
- Pubic/axillary hair
- Menarche (~2 years after breast development)

Boys:

- Testicular enlargement
- Penis lengthening
- Pubic hair appearance
- Growth spurt (~1 year after testes enlarge)

Stages 1–5: How the body changes during puberty

- Stage 1: No puberty signs yet
- Stage 2: First visible changes begin
- Stage 3: Clear growth and development
- Stage 4: Near-adult appearance
- Stage 5: Fully developed mature stage

Why Tanner Staging is Important

- Track healthy puberty development
- Detect early or delayed puberty
- Monitor growth disorders or endocrine problems
- Guide medical treatment if needed

Nutritional Requirements: Macronutrients

Carbohydrates

Primary energy source for the body and brain. Essential for fueling growth, physical activity, and cognitive function.

45-75% of total energy

Recommended daily intake

Best Sources:

- Whole grains (oats, brown rice, quinoa)
- GØÞÒRŒEMÕÑ QÑNÑÞMNÕÑŒ
- Legumes (beans, lentils, chickpeas)
- Starchy vegetables (potatoes, squash)

Protein

Building blocks for bones, muscles, cartilage, skin, skin, blood, and hormones. Critical for growth and and repair.

10-15% of total energy

May exceed during adolescence

Best Sources:

- I ÑMÕ Ö ÑMRŒÄŃÒÒŃÔÑÕŒEPÞØÔÑŘŒNÑÑŅÅ
- Fish and seafood
- Eggs and dairy products
- Plant-based: tofu, beans, lentils, nuts

Fats

Essential for cell function, hormone production, and and absorption of fat-soluble vitamins (A, D, E, K). K).

20-35% of total energy

Focus on quality over quantity

Best Sources:

- Avocados and olive oil
- Nuts and seeds
- Fatty fish (salmon, mackerel)
- Limit: saturated <10%, trans <1% <1%

Daily Caloric Needs

A moderately active adolescent girl requires approximately **2,300 kcal/day**, while boys may need **2,800-3,200 kcal/day** depending on activity level and growth stage. Needs growth stage. Needs are more strongly correlated with growth rates than with chronological age.

Critical Micronutrients: Calcium & Vitamin D

Calcium

1,300 mg/day (ages 9-18)

Essential for building strong bones and teeth. Your body will build most of your bone mass before your early twenties.

Top Food Sources:

- Low-fat milk, yogurt, cheese (3 cups/day)
- Fortified plant-based beverages
- Leafy greens (spinach, kale)
- Calcium-set tofu, almonds, figs
- figs

Vitamin D

600 IU/day (ages 1-18)

Crucial for calcium absorption and bone health. Also supports immune function and muscle health.

Top Food Sources:

- Fatty fish (salmon, tuna, mackerel)
- Fortified dairy and plant milks
- Egg yolks, fortified cereals
- Sunlight exposure (10-30 min/day)

Why Adolescence is Critical for Bone Health

50%+

of lifetime bone mass accumulated during teenage years

1,600

mg/day calcium may be required during peak growth

Research shows that calcium intake during adolescence directly affects skeletal calcium retention. Adolescent females at puberty represent the optimal population for early osteoporosis prevention through adequate calcium intake.

Consequences of Inadequate Intake

Special Populations: African American adolescents and those in northern latitudes may need higher vitamin D supplementation (800-1000 IU) due to reduced sun exposure and skin pigmentation effects on vitamin D synthesis.

Critical Micronutrients: Iron, Iodine & Other Essentials

Iron

Most common nutritional deficiency globally. Essential for hemoglobin production, oxygen transport, cognitive function, and immune health.

Critical for Adolescent Girls

Increased needs due to menstruation and rapid growth

Best Sources:

Red meat, dark poultry, lentils, beans, fortified cereals, spinach

Iodine

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Heightened Needs in Adolescence

Essential for pubertal development and cognitive maturation

Best Sources:

Iodized salt, seafood, dairy products, eggs

Vitamin A

Supports vision, immune function, and cell growth. Important for skin health and tissue repair during rapid growth.

Best Sources:

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Zinc

Essential for growth, immune function, wound healing, and DNA synthesis. Supports normal growth and development during puberty.

Best Sources:

Meat, shellfish, legumes, seeds, nuts, whole grains

Potassium

Helps regulate blood pressure, supports heart and muscle function, and maintains proper fluid balance.

Best Sources:

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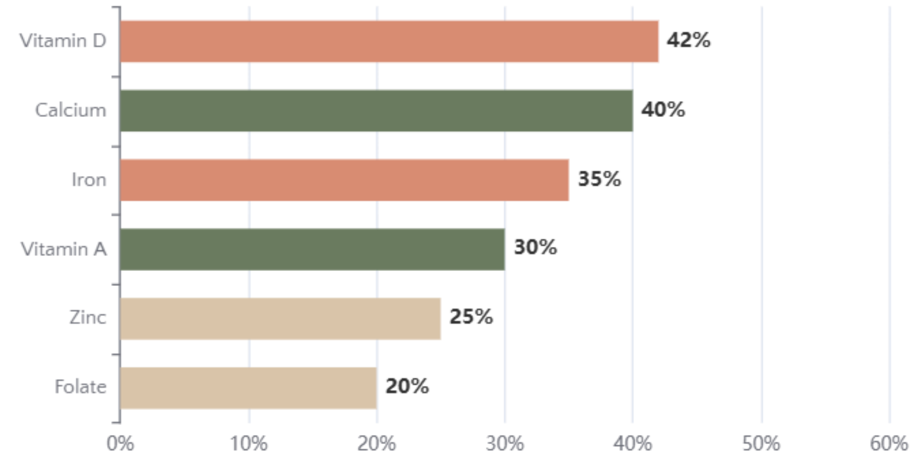
Key Insight: Iron deficiency is the most prevalent nutritional disorder affecting malnourished adolescents globally. It can impair neurodevelopment, reduce physical capacity, and increase infection risk. Adolescent girls are particularly vulnerable due to menstrual losses combined with rapid growth demands.

Common Nutritional Deficiencies in Adolescents

Prevalence of Key Deficiencies



Global Statistics

According to WHO data, **more than half of children under five and over two-thirds of non-pregnant non-pregnant women of reproductive age are deficient in at least one key micronutrient** (typically **micronutrient** (typically iron, zinc, vitamin A, or folate). In South Asia, 55% of adolescent girls aged 15- girls aged 15-19 are anemic.

Vitamin D Deficiency

21-42% of teenagers affected. Consequences include impaired bone mineralization, increased fracture increased fracture risk, weakened immune function, and mood disturbances. Risk factors include include limited sun exposure, darker skin pigmentation, and inadequate dietary intake.

Calcium Inadequacy

Many adolescents fail to meet the recommended 1,300 mg/day. Results in suboptimal peak bone mass, increasing osteoporosis risk later in life. Particularly concerning for girls who face additional bone loss during pregnancy and menopause.

Iron Deficiency Anemia

Most common deficiency globally. Adolescent girls at highest risk due to menstruation. Causes fatigue, Causes fatigue, impaired cognitive function, reduced physical capacity, weakened immunity, and poor immunity, and poor academic performance.

Warning Signs to Watch For

- Persistent fatigue and lethargy
- Difficulty concentrating, poor academic performance performance
- Frequent infections or slow wound healing
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Bone Health: Building Your Foundation

Why Adolescence Matters Most

1. **Peak Bone Mass Window**
   Most skeletal mass accumulated by late adolescence
2. **Irreversible Opportunity**
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3. **Osteoporosis Prevention**
   Higher peak bone mass = lower fracture risk later later

Factors Affecting Peak Bone Mass

Genetics
60-80% influence

Nutrition
Calcium & vitamin D

Physical Activity
Weight-bearing exercise

Hormones
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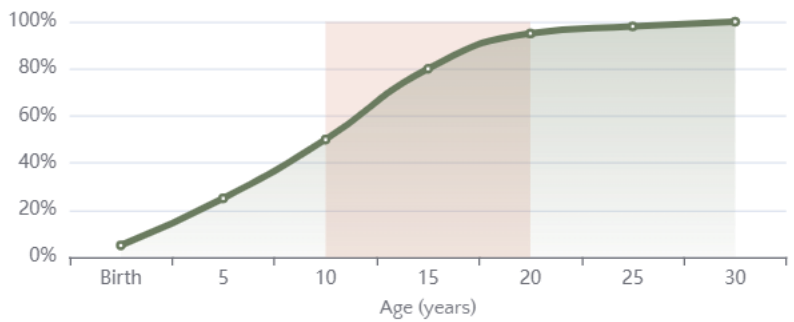
Bone Mass Accumulation Timeline



Special Considerations

High-Risk Groups for Vitamin D Deficiency

- African American adolescents (increased skin pigmentation reduces synthesis)
- Those in northern latitudes with limited winter sun
- Individuals with limited outdoor activity

Recommendation: May need 800-1000 IU vitamin D daily

Key Research Finding: Studies show that calcium intake of up to 1,600 mg/day during adolescence may be required to optimize skeletal calcium retention and achieve maximal peak bone mass.

Healthy Eating Guidelines: WHO Recommendations

Core Principles

- **Adequacy:** Meet nutritional needs for growth and activity
- **Diversity:** Variety within and across food groups
- **Balance:** Appropriate proportions of macronutrients
- **Moderation:** Limit processed foods and unhealthy fats

Remember: A healthy dietary pattern is influenced by availability, affordability, preferences, culture, and traditions. Focus on whole, minimally processed foods.

Fruits & Vegetables

≥400g per day (5+ servings)

Include a variety of colors. Fresh, frozen, or canned (without added sugars or sodium) all count. Whole fruits preferred over juices.

Whole Grains & Fiber

≥25g fiber daily

Choose whole grains (oats, brown rice, quinoa, whole wheat) over refined. Carbohydrates should comprise 45-75% of total energy.

Limit Free Sugars

<10% of total energy (ideally <5%)

That's ≤50g (12 tsp) for 2,000 kcal diet. Includes added sugars and sugars in honey, syrups, fruit juices, and concentrates.

Healthy Fats & Sodium

Fats: 20-35% of energy, mostly unsaturated. Saturated fat <10%, trans fat <1%. **Sodium:** <2g/day (5g salt). Choose unsalted nuts, avocados, olive oil.

Meal Planning: Practical Tips for Busy Teens

Daily Targets

2 Fruit servings	**5-5½** Vegetable servings
3 Cups dairy	**Every** Meal: lean protein

Quick Meal Ideas (<30 min)

- **Stir-fries:** Veggies + chicken/tofu + brown rice
- **Grain bowls:** Quinoa + beans + roasted vegetables
- **Quesadillas:** Whole wheat + cheese + black beans + peppers
- **Smoothies:** Yogurt + fruit + spinach + nut butter
- **Pasta:** Whole grain + tomato sauce + lean meat + veggies

Meal Prep Tip: Batch cook grains, proteins, and chopped vegetables on weekends for quick assembly during busy weekdays.

Healthy Snack Options

Protein-Rich
- Greek yogurt + fruit
- Nuts & seeds mix
- Hummus + veggie sticks

Energy-Boosting
- Peanut butter + apple
- Whole grain crackers + cheese
- Trail mix (unsalted)

Quick & Easy
- Hard-boiled eggs
- String cheese + fruit
- Homemade energy balls

Hydrating
- Fresh fruit
- Veggie sticks + guac
- Smoothie popsicles

Encourage Teen Involvement

Involve adolescents in meal planning, grocery shopping, and cooking. This builds confidence, autonomy, and lifelong healthy eating skills. Start with simple tasks like washing vegetables or mixing ingredients, then progress to full meal preparation.

Physical Activity & Sports Nutrition

Carbohydrates: The Primary Fuel

≥50% of diet for athletes

Up to 70% for intense exercise programs

Carbs are stored as glycogen in muscles and are the only fuel for power moves. Insufficient intake leads intake leads to premature fatigue.

Pre-Exercise (3-4 hours before):

4g carbs/kg body weight

During Exercise (>60 min):

0.7g carbs/kg/hour every 15-20 min

Post-Exercise (recovery):

1-1.5g carbs/kg within 30 min

Protein for Muscle Recovery

"30 for 30" Rule

30g protein within 30 minutes post-exercise

Protein is essential for muscle synthesis and repair. Adolescent athletes need approximately **1.3-1.8g** approximately **1.3-1.8g protein/kg/day**.

Real Food Sources (No Supplements Needed):

- ✓ Chicken breast (31g per 100g)
- ✓ Greek yogurt (10g per 100g)
- ✓ Eggs (6g each), Beans (7-9g per ½ cup)

Hydration Strategy

Before (4 hours prior): 16-20 oz fluid

Before (10-15 min prior): 8-12 oz water

During (<60 min): 3-8 oz water every 15-20 min

During (>60 min): Sports drinks with electrolytes

After: 16-24 oz for every pound lost

⚠ **Warning:** Excessive protein intake doesn't enhance muscle mass and may burden kidneys. Protein supplements are unnecessary when whole foods provide adequate intake.

Hydration: The Forgotten Nutrient

Daily Fluid Requirements

♀

2.0–2.5L

Girls (14-18 years)

♂

2.5–3.3L

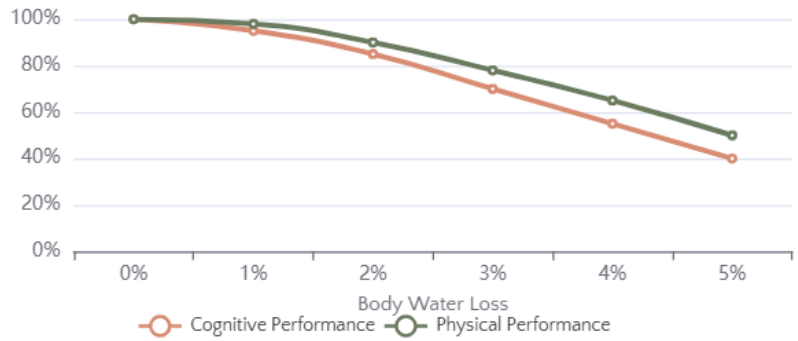
Boys (14-18 years)

Includes water from beverages and food (~20% from food)

Why Adolescents Are at Higher Risk

- **Higher surface-area-to-mass ratio:** Absorb more heat from environment
- **Greater heat production:** More metabolic heat per unit mass during activity activity
- **Less efficient sweating:** Reduced capacity to dissipate heat
- **Underdeveloped thirst mechanism:** Don't feel thirsty even when dehydrated dehydrated

Effects of Dehydration



Warning Signs

Mild (1–2% loss):

- Thirst, dry mouth
- Headache, fatigue
- Decreased urine

Moderate (3–5% loss):

- Dizziness, irritability
- Poor concentration
- Muscle cramps

Practical Hydration Tips

- ✓ Carry a reusable water bottle
- ✓ Drink water with every meal and snack
- ✓ Monitor urine color (pale yellow = hydrated)
- ✓ Increase intake during hot weather and exercise exercise

Eating Disorders & Body Image Concerns

The Scope of the Problem

5%

of female teenagers affected by eating disorders

Eating disorders significantly impact physical and mental health. Adolescence is a particularly vulnerable period due to rapid physical changes, social pressures, and identity formation.

Contributing Factors

- **Social Media:** Unrealistic body ideals, constant comparison
- **Peer Pressure:** Body shaming, bullying, social exclusion
- **Cultural Pressure:** Societal fixation on thinness
- **Personal Factors:** Perfectionism, low self-esteem, anxiety

Warning Signs

Behavioral Changes:

- Excessive focus on weight, calories, dieting
- Avoiding meals or eating in secret
- Dramatic increase in exercise
- Withdrawal from friends and activities

Physical Signs:

- Significant weight loss or gain
- Amenorrhea (missed periods in girls)
- Fatigue, dizziness, cold intolerance
- Gastrointestinal problems

Health Consequences

- **Osteopenia/Osteoporosis:** Low estrogen leads to irreversible bone loss
- **Cardiac Issues:** Irregular heartbeat, low blood pressure
- **Cognitive Impairment:** Difficulty concentrating, poor academic performance
- **Hormonal Disruption:** Delayed puberty, fertility issues

Treatment Approach

Multidisciplinary team: Physician + Dietitian + Therapist. Cornerstones: nutritional rehabilitation, weight restoration, return of natural menstruation. Family support and open communication about nutrition are essential.

Assignment:

Each student has been assigned a book chapter. You must complete the following three tasks:

Presentation (5–10 slides)

- Based ONLY on your assigned textbook chapter.

Prepare 5 Questions

- Create five questions from your presentation/chapter.
- These questions may be used in the exam.

Case Studies

- Solve the case studies in your chapter.

Nutritional issues are widespread and serious, and adolescents should be considered a priority group because the consequences of deficiencies can affect their entire adult lives.