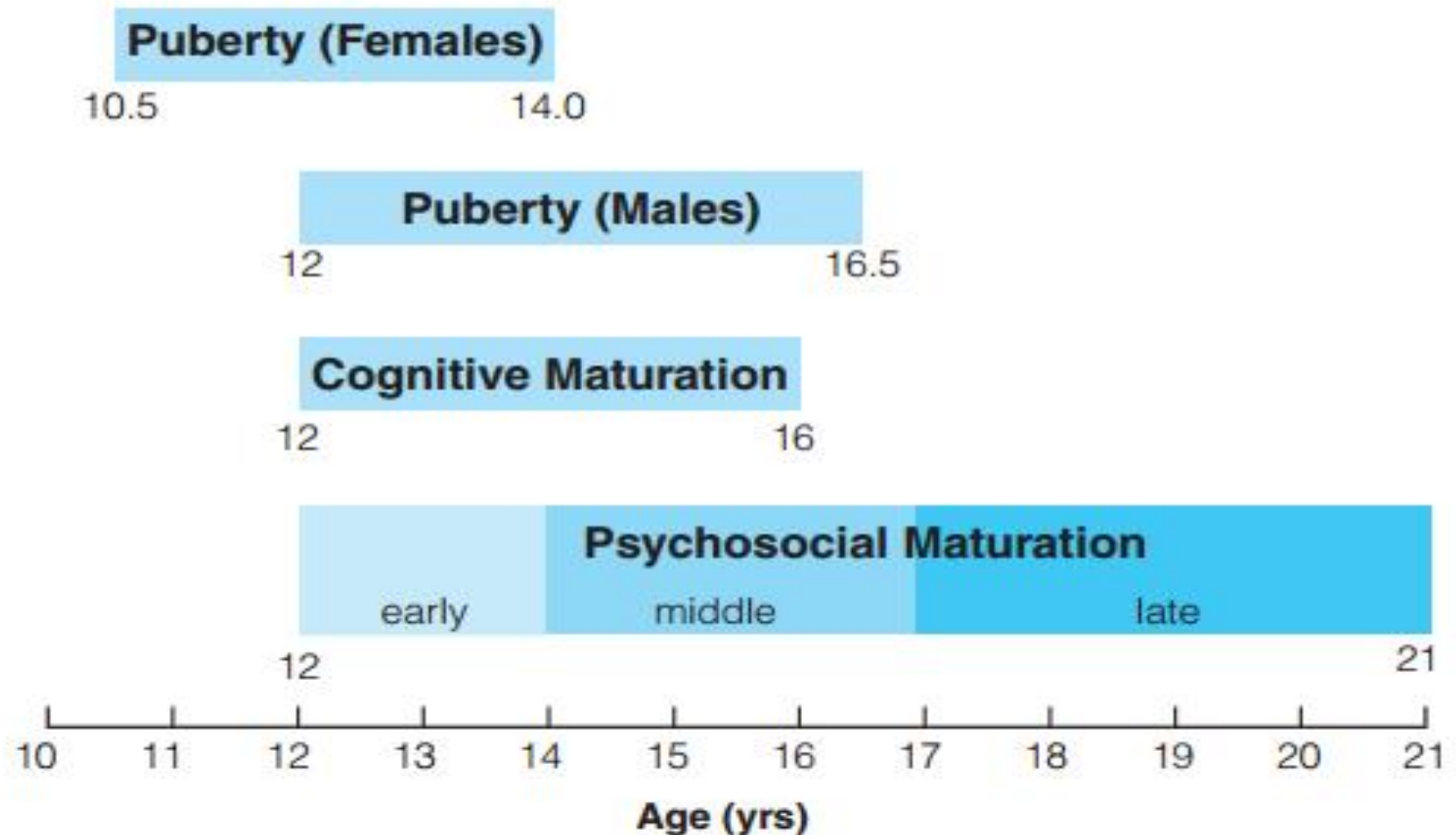


# Chapter 14: Adolescents Nutrition

Adolescence

the period of life  
between 11 and 21  
years of age

**Illustration 14.1** Average ages of pubertal, cognitive, and psychosocial maturation.



# Nutritional Needs in a Time of Chang

- The biological, psychosocial, and cognitive changes associated with adolescence have direct effects on nutritional status
- The **dramatic physical growth** and development experienced by adolescents significantly increases their needs for energy, protein, vitamins, and minerals

# Nutritional Needs in a Time of Chang

- The **struggle for independence** that characterizes adolescent psychosocial development often leads to the development of **health-compromising eating behaviors**:
  - excessive dieting
  - meal skipping
  - use of unconventional nutritional and non-nutritional supplements
  - the adoption of fad diets

# Physical Growth and Development

- ***Puberty*** : the physical transformation of a child into a young adult
- The biological changes that occur during puberty include:
  - sexual maturation
  - increases in height and weight
  - accumulation of skeletal mass
  - changes in body composition

# Physical Growth and Development

- Variation in nutritional needs depending on the **onset of puberty**
- **Sexual maturation** (**or biological age**) should be used to assess biological growth and development and the individual nutritional needs of adolescents rather than chronological age
- **Table 14.1** Sexual maturity rating for girls and boys

**TABLE 14.1** ▶ Sexual maturity rating for girls and boys

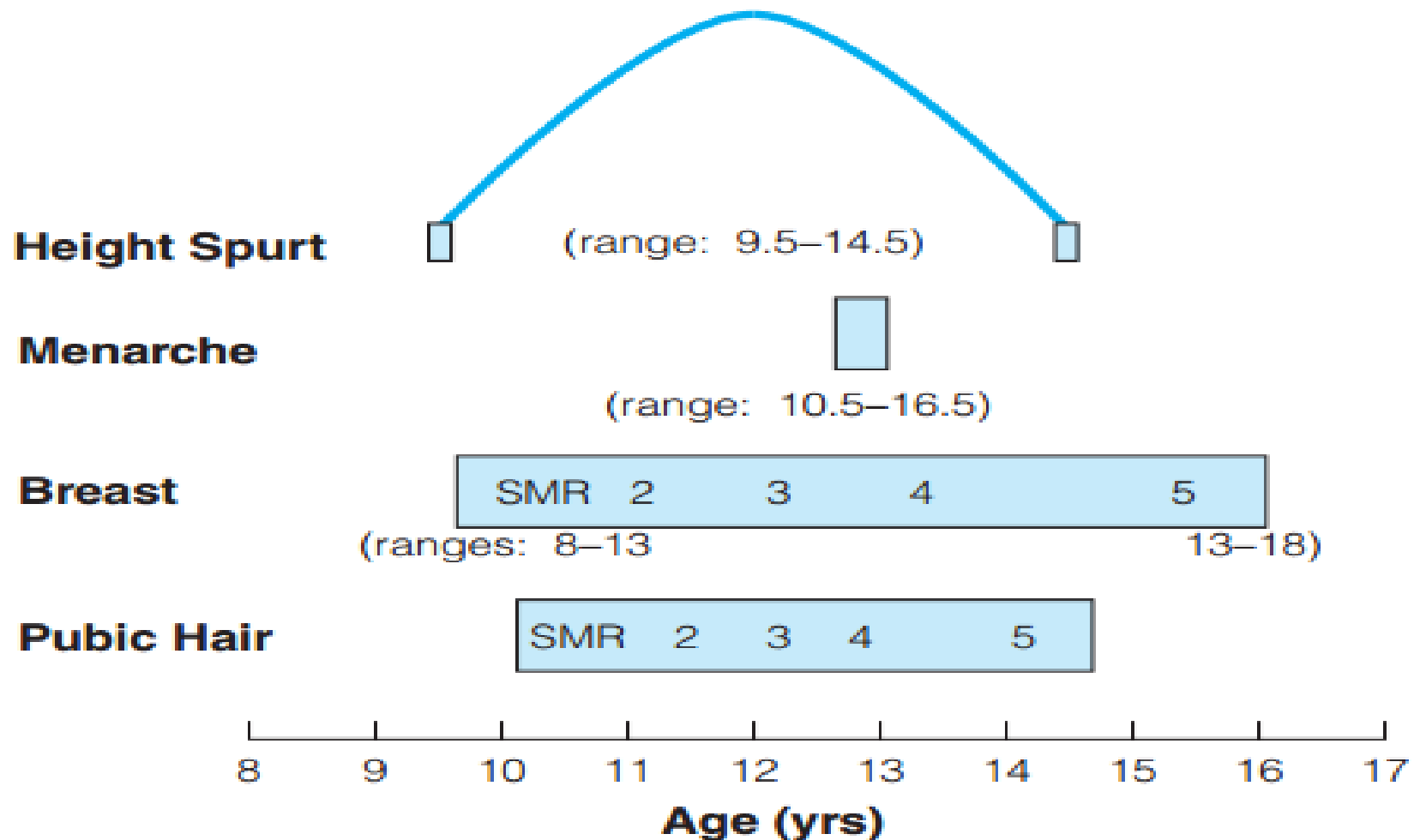
STAGE GIRLS	BREAST DEVELOPMENT	PUBIC HAIR GROWTH
1	Prepubertal; nipple elevation only	Prepubertal; no pubic hair
2	Small, raised breast bud	Sparse growth of hair along labia
3	General enlargement of raising of breast and areola	Pigmentation, coarsening, and curling, with an increase in amount
4	Further enlargement with projection of areola and nipple as secondary mound	Hair resembles adult type, but not spread to medial thighs
5	Mature, adult contour, with areola in same contour as breast, and only nipple projecting	Adult type and quantity, spread to medial thighs

STAGE BOYS	GENITAL DEVELOPMENT	PUBIC HAIR GROWTH
1	Prepubertal; no change in size or proportion of testes, scrotum, and penis from early childhood	Prepubertal; no pubic hair
2	Enlargement of scrotum and testes; reddening and change in texture in skin of scrotum; little or no penis enlargement	Sparse growth of hair at base of penis
3	Increase first in length, then width of penis; growth of testes and scrotum	Darkening, coarsening, and curling; increase in amount
4	Enlargement of penis with growth in breadth and development of glands; further growth of testes and scrotum, darkening of scrotal skin	Hair resembles adult type, but not spread to medial thighs
5	Adult size and shape genitalia	Adult type and quantity, spread to medial thighs

SOURCE: Growth at Adolescence, J. M. Tanner, Copyright © 1962 Blackwell Publishers. Reprinted with permission of John Wiley & Sons, Inc.



## Illustration 14.2 Sequence of physiological changes during puberty in females.

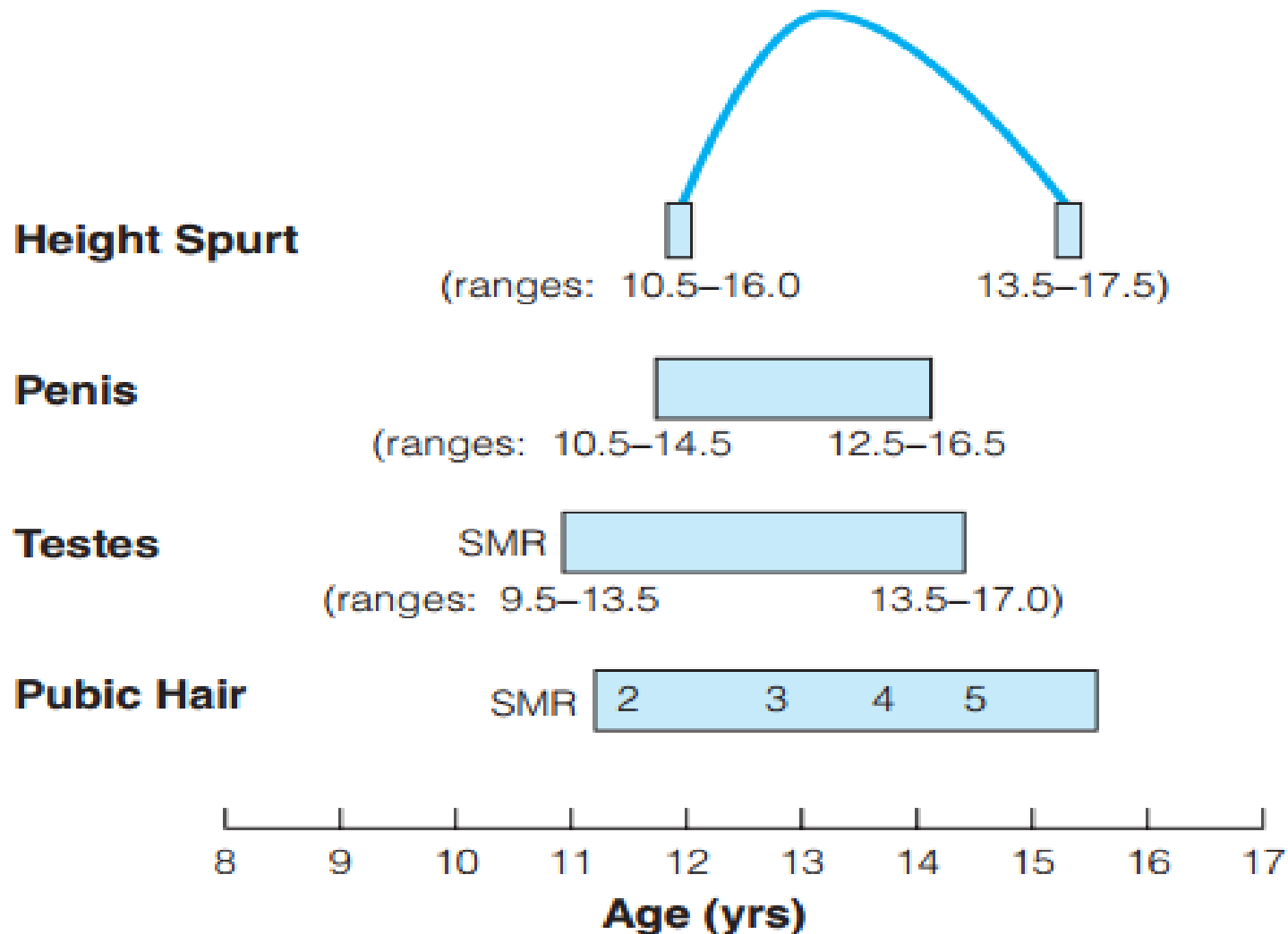


# Physiological changes in females

- *Menarche* occurs 2 to 4 years after the initial development of breast buds and pubic hair

The *linear growth spurt* lasts 24 to 26 months, ceasing by age 16 in most females

### Illustration 14.3 Sequence of physiological changes during puberty in males.



# Physiological changes in males

- The peak velocity of linear growth occurs at 14.4 years of age, on average.
- At the peak of the growth spurt, adolescent males will increase their height by 2.8 to 4.8 inches (7 to 12 cm) a year.
- Linear growth will continue throughout adolescence, at a progressively slower rate, ceasing at about 21 years of age

# Changes in Weight, Body Composition, and Skeletal Mass

- During the peak velocity of weight change, which occurs at an average age of 12.5 years, girls will gain approximately 18.3 lb (8.3 kg) per year
- Peak accumulation of muscle mass occurs around or just after the onset of menses

# Body composition changes in females

- average **lean body mass** falling from 80% to 74% of body weight while average **body fat** increases from 16% to 27% at full maturity
- Females experience a 44% increase in lean body mass and a 120% increase in body fat during puberty

# Body composition changes in females

- Researchers suggest that a level of 17% body fat is required for menarche to occur
- 25% body fat is required for the development and maintenance of regular ovulatory cycles.
- Normal changes in body fat mass can be mediated by :
  - excessive physical activity
  - severe caloric restriction.

# Body composition changes in males

- During peak weight gain, adolescent males gain an average of 20 lb (9 kg) per year.
- **Body fat decreases** in males during adolescence, resulting in an average of approximately 12% by the end of puberty



# Peak bone mass

- By age 18, more than 90% of adult skeletal mass has been formed.
- A variety of factors contribute to the accretion of bone mass, including :
  - Genetics
  - Hormonal changes
  - weight-bearing exercise
  - cigarette smoking
  - consumption of alcohol
  - Dietary intake of calcium, vitamin D, protein, phosphorus, boron, and iron

# Psychosocial Development

- it is divided into three periods:
  - early adolescence (11 to 14 years)
  - middle adolescence (15 to 17 years)
  - late adolescence (18 to 21 years)

– TABLE 14.2

**Table 14.2** Psychosocial processes and the substages of adolescent development

Substage	Emotional and Social Development	Cognitive Development
Early adolescence	<ul style="list-style-type: none"><li>• Alterations in body image secondary to dramatic changes in body shape and size</li><li>• Increased awareness of sexuality</li><li>• Strong need for social acceptance by peers</li><li>• Strong sense of impulsivity</li></ul>	<ul style="list-style-type: none"><li>• Concrete thinking processes are dominant, often with limited abstract thought capacity</li></ul>
Middle adolescence	<ul style="list-style-type: none"><li>• Development of greater autonomy from parents and family</li><li>• Continued need for peer acceptance, which may lead to risk-taking behaviors</li><li>• Increased opportunities for employment outside of home, resulting in more decision making and the beginning of economic independence</li><li>• Increased awareness of moral and social issues</li></ul>	<ul style="list-style-type: none"><li>• Development of abstract reasoning continues</li><li>• May revert to concrete thinking when under stress</li></ul>
Late adolescence	<ul style="list-style-type: none"><li>• Further development of personal set of morals and values</li><li>• Increased impulse control</li><li>• Greater social, emotional, and economic independence from family</li><li>• Reduced need for peer acceptance</li><li>• Development of personal and vocational goals</li></ul>	<ul style="list-style-type: none"><li>• Abstract thought capacity fully develops</li></ul>

SOURCE: From G. M. Ingersoll, "Psychological and Social Development," in Textbook of Adolescent Medicine. Copyright © 1992 Saunders. Reprinted with permission.

# Psychosocial Development

- Teens express their ability and willingness to fit in with a group peers by **adopting food preferences** and making food choices based on peer influences and by refusing family preferences and choices
- Peer pressure may lead to **positive / negative** dietary impact

# Early Adolescence

- Cognitively , early adolescence is characterized by :
  - concrete thinking, egocentrism, and impulsive behaviors
  - Abstract reasoning abilities are not yet developed to a great extent in most adolescents → limiting their ability to understand **complex health and nutrition issues**
    - lack the ability to see how their current behavior can affect their future health status or health related behaviors

# Middle Adolescence

- Conflicts over personal issues, including eating and physical activity behaviors, are heightened during mid-adolescence
- Peer groups become more influential
- Teens begin to understand the relationship between current health-related behaviors and future health, even though their need to “fit in” may supplant this understanding

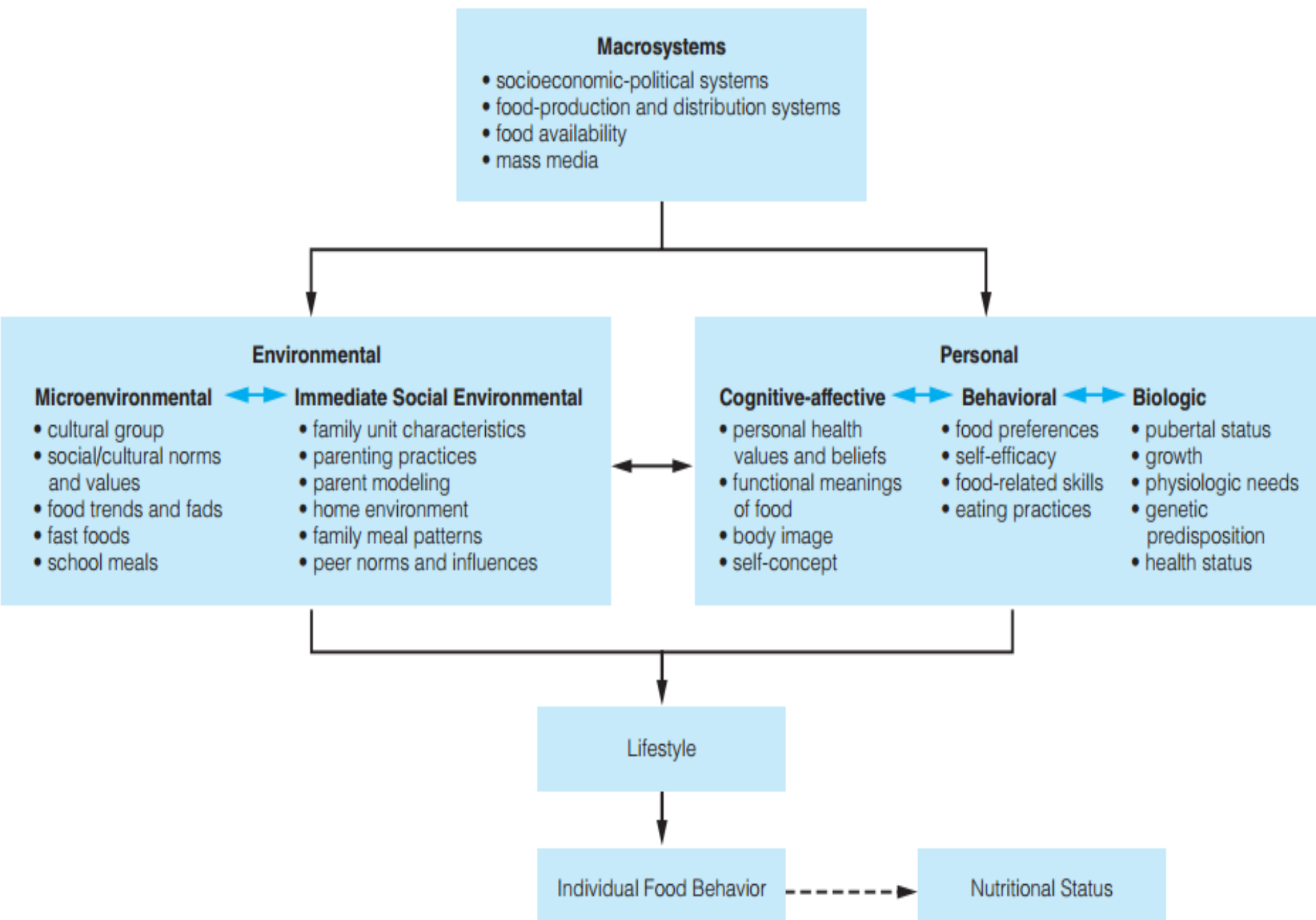
# Late Adolescence

- characterized by the development of a personal identity and individual moral beliefs.
- Physical growth and development is largely concluded, and body image issues are less prevalent.
- **Abstract thinking** capabilities are realized during late adolescence

# Health and Eating Related Behaviors During Adolescence

- Illustration 14.4 : conceptual model of the many factors that influence eating behaviors of adolescents
- To improve the eating patterns of youth, **nutrition interventions should be aimed at each of the three levels of influence**





# Snacking

- Increased snacking (mostly high in fat, sugars, and sodium)
- Health practitioners working with adolescents need to understand that **snacking is a commonplace behavior** among adolescents
- and should work with adolescents **to improve food choices rather than discouraging snacking.**

# Meal skipping (mostly breakfast)

- Adolescents who skip meals should be counseled on convenient, portable, and healthy food choices that can be taken with them and eaten as meals or snacks

# Eating at fast-food restaurants

- Specific choices can be made to increase the nutrient content of fast-food meals and decrease the fat content
  - Ask for juice, water, or milk instead of soft drinks
  - Order small sandwiches instead of larger choices
  - Choose a salad or baked potato as a side dish instead of French fries
  - order grilled items as opposed to fried sandwiches
  - avoid “super-sizing” meals even if it seems to offer a better economic deal

# Vegetarian Diets

**Table 14.3** Types of vegetarian diets and foods excluded

Type of Vegetarian Diet	Foods Excluded
Semi- or partial-vegetarian	Red meat
Lacto-ovo-vegetarian	Meat, poultry, fish, seafood
Lacto-vegetarian	Meat, poultry, fish, seafood, eggs
Vegan (total vegetarian)	Meat, poultry, fish, seafood, eggs, dairy products (may exclude honey)
Macrobiotic	Meat, poultry, eggs, dairy, seafood, fish (fish may be included in the diets of some macrobiotic vegetarians)

# Vegetarian Diets

- The prevalence of vegetarianism among adolescents is small—approximately 4%
- but almost 11% report having identified themselves as vegetarian at some point in time.

# Reasons to adopt the vegetarian diet

- Cultural or religious beliefs
- Moral or environmental concerns
- Health beliefs, as a means to restrict calories and/or fat intake
- As a means of **exerting independence** by adopting eating behaviors that differ from those of the teen's family

# Vegetarian Diets

As a rule, the more foods that are **restricted** in the diet, the more likely it is that nutritional **deficiencies** will result



# Vegetarian Diets

- Vegetarian adolescents have been found to be shorter and leaner than omnivores during childhood and to enter puberty at a later age
- **After puberty**, vegetarian adolescents are as tall as or taller than omnivores and are generally leaner, although final adult height may be reached at a later age.

# Vegetarian Diets

- Well-planned vegetarian diets can offer many health advantages to adolescents, such as :
  - High intake of fiber
  - High intake of the vitamins and minerals found in plant-based foods
- Data suggest that vegetarian adolescents consume more fruits and vegetables, fewer sweets, fewer salty snack foods, and less fat compared to omnivorous teens

# Vegetarian Diets

- When well-planned, vegetarian diets can provide **adequate protein** to promote growth and development among pubescent adolescents
- Particularly if small amounts of animal-derived foods, such as milk or cheese, are consumed at least two times per week

# Vegetarian Diets

- If vegetarian diets restrict intake of all animal-derived food products such as in **vegan diets**
- careful attention must be paid to ensure adequate intakes of :
  - Protein???
  - Calcium
  - Zinc
  - Iron
  - vitamins D, B6, and B12.
- Supplements of vitamins **B12** and **D** and **calcium** are often required among vegans **unless fortified foods are routinely consumed**

# Vegetarian Diets

- Adolescents who consume vegan diets must also be assessed for **adequacy of total fat and essential fatty acid intakes**.
- Docosahexaenoic acid (DHA) is derived from alpha-linolenic acid.
- Although it is found in soy products, flaxseed, nuts, eggs, and canola oil, intake is very low in the diets of vegans

# **Energy and Nutrient Requirements of Adolescent**

# Requirements

- Increases in :
  - lean body mass
  - skeletal mass
  - body fat
- result in energy and nutrient needs that exceed those at any other point in life

# Requirements

- The Dietary Reference Intakes (DRIs) provide the best estimate of nutrient requirements for adolescents (Table 14.7).
  - these nutrient recommendations are classified **according to chronological age**, as opposed to individual levels of biological development.
  - Thus, health care professionals must use prudent **professional judgment based on SMR status**, and not solely on chronological age, when determining the nutrient needs of an adolescent



**Table 14.7** Dietary reference intakes of selected nutrients for preadolescents and adolescents

Life-Stage Group	Calcium (mg/d)	Phosphorus (mg/d)	Magnesium (mg/d)	Vitamin D (mg/d) <sup>a,b</sup>	Fluoride (mg/d)	Thiamin (mg/d)	Riboflavin (mg/d)	Niacin (mg/d) <sup>c</sup>	
Males									
9–13 years	1300*	1250	240	5*	2*	0.9	0.9	12	
14–18 years	1300*	1250	410	5*	3*	1.2	1.3	16	
19–30 years	1000*	700	400	5*	4*	1.2	1.3	16	
Females									
9–13 years	1300*	1250	240	5*	2*	0.9	0.9	12	
14–18 years	1300*	1250	360	5*	3*	1.0	1.0	14	
19–30 years	1000*	700	310	5*	3*	1.1	1.1	14	
Pregnancy									
<18 years	1300*	1250	400	5*	3*	1.4	1.4	18	
19–30 years	1000*	700	350	5*	3*	1.4	1.4	18	
Lactation									
<18 years	1300*	1250	360	5*	3*	1.4	1.6	17	
19–30 years	1000*	700	310	5*	3*	1.4	1.6	17	
Life-Stage Group	Vitamin B <sub>6</sub> (mg/d)	Folate, (mg/d)	Vitamin B <sub>12</sub> (mg/d)	Pantothenic Acid (mg/d)	Biotin (mg/d)	Choline (mg/d) <sup>d</sup>	Vitamin C (mg/d)	Vitamin E (mg/d)	Selenium (mg/d)
Males									
9–13 years	1.0	300	1.8	4*	20*	375*	45	11	40
14–18 years	1.3	400	2.4	5*	25*	550*	75	15	55
19–30 years	1.3	400	2.4	5*	30*	550*	90	15	55
Females									
9–13 years	1.0	300	1.8	4*	20*	375*	45	11	40
14–18 years	1.2	400 <sup>e</sup>	2.4	5*	25*	400*	65	15	55
19–30 years	1.3	400 <sup>e</sup>	2.4	5*	30*	425*	75	15	55
Pregnancy									
<18 years	1.9	600	2.6	6*	30*	450*	80	15	60
19–30 years	1.9	600	2.6	6*	30*	450*	85	15	60
Lactation									
<18 years	2.0	500	2.8	7*	35*	550*	115	19	70
19–30 years	2.0	500	2.8	7*	35*	550*	120	19	70

# Diet adequacy of adolescents

- On average, adolescents consume diets **inadequate in several vitamins and minerals**, including folate; vitamins A, B6, C, and E; and iron, zinc, magnesium, phosphorus, and calcium
- **exceed current recommendations** for total and saturated fats, cholesterol, sodium, and added sugar
- Inadequacy is seen **in females** more than males

# Energy

- influenced by :
  - Activity level
  - Basal metabolic rate
    - associated with the amount of lean body mass of individuals.
    - Males > females
  - increased requirements to support pubertal growth and development
- Table 14.9

# Energy

- When energy intakes fail to meet requirements:
  - linear growth may be retarded
  - sexual maturation may be delayed

# Protein

- influenced by the amount of protein required for:
  - maintenance of existing lean body mass
  - allowances for the amount required to accrue **additional lean body mass** during the adolescent growth spurt
- The estimated protein need for adolescents is **0.85 g/kg body weight/day**, slightly higher than that of adults

# Protein

- When protein intakes are consistently **inadequate**:
  - reductions in linear growth
  - delays in sexual maturation
  - reduced accumulation of lean body mass may be seen

# Protein

- Subgroups of adolescents may be **at risk for marginal or low protein intakes**, including:
  - those from food-insecure households
  - those who severely restrict calories
  - those who consume vegetarian diets, most notably vegans.

# Carbohydrates

- The recommended intake of carbohydrate among teens is 130 g/day or 45–65% of daily energy needs
- **Sweeteners and added sugars** provide approximately 21% of energy intake by teens



# Dietary Fiber

- The DRIs set the recommended intake of dietary fiber:
  - for adolescent females at 26 g/day
  - for males <14 years of age at 31 g/day
  - For older adolescent males at 38 g/day
- The consumption is 12-14 g/ day !!!

# Fat

- Current recommendations suggest that children over the age of 2 years consume:
  - no more than 25–35% of calories from fat
  - with no more than 10% of calories derived from saturated fat
- Consumption is around 30 %

# Calcium

- Because about **half of peak bone mass** is accrued during adolescence, calcium intake may be of great importance for :
  - the development of dense bone mass
  - the reduction of the **lifetime risk** of fractures and osteoporosis.

# Calcium

- Calcium needs and absorption rates are higher during adolescence than any other time except infancy.
- Retain calcium 4 times more than adults
- Adolescent females have the greatest ability to absorb calcium at about the time of menarche

# Calcium

- **Males** accrue more bone mass than females at all ages during puberty,
- Possibly due to that females have :
  - lower intake of calcium
  - less weight-bearing stress on bone tissue
  - hormonal influences.

# Calcium

- The DRI for calcium for 9- to 18-year-olds is 1300 mg per day
- Data suggest that many adolescents, most notably females, **do not consume the DRI for calcium**
  - May need supplements
  - If diet do not contain dairy products → **Calcium fortified foods** should be consumed

# Calcium

- Studies have shown an **inverse relationship** between the intake of **sweetened and carbonated beverages** and the intake **of milk and juice**
- Studies suggest that females who **restrict calories** in an effort to control their weight are at particularly high risk for **inadequate calcium intakes!!**

# Iron

- Increased needs:
  - rapid rate of linear growth
  - The increase in blood volume
  - the onset of menarche
- The actual iron requirements of adolescents are **based on sexual maturation level**. (not chronological age)
- Highest during:
  - the adolescent growth spurt in males
  - after menarche in females



# Vitamin D

- Plays an essential role in :
  - facilitating intestinal absorption of calcium and phosphorus that is required to maintain adequate serum levels of these minerals
- Limited vitamin D production:
  - Dark skin pigmentation
  - who live in northern latitudes

# Vitamin D

- Decreases in serum vitamin D status were seen among all age and race/ethnicity groups
- **Females** showed greater decreases in serum vitamin D status than did males.
- Vitamin D insufficiency among adolescents of color should be considered a **major public health-nutrition issue.**

# Low levels of vitamin D

- Low levels of vitamin D is associated with:
- Low systolic blood pressure, fasting plasma glucose levels
- hypertriglyceridemia
- metabolic syndrome
- low HDL cholesterol levels
- higher BMI and abdominal obesity measurements. (presentation topic)

# Vitamin D sources

- Vitamin D is naturally found in very few foods—namely:
  - fatty fish, fish oils, and egg yolks of hens provided with vitamin D-fortified feed.
- The majority of dietary vitamin D intake in North America comes from fortified foods such as :
  - Milk, breakfast cereals, margarines, and some juices

# Vitamin D

- Vitamin D intake and adequacy should be assessed for all adolescents of high-risk groups, particularly:
  - those who live in northern climates
  - who have limited sun exposure
  - who have lactose intolerance or milk allergy
  - who have developmental disabilities that may limit outdoor activities
  - who have darkly pigmented skin

# Folate

- adolescents have increased requirements for folate during puberty
  - integral part of DNA, RNA, and protein synthesis
- serum folate levels drop during adolescence as sexual maturation proceeds
  - suggesting that increased folate needs during growth and development are not being met

# Folate

- it is imperative that all women of reproductive age (15–44 years old) consume adequate folic acid, preferably through dietary sources, or if needed, through supplements.

# Nutritional Assessment of Adolescents

**TABLE 14.8** ▶ Example of height and weight status for adolescents

WEIGHT STATUS CATEGORY	PERCENTILE RANGE
Underweight	Less than the 5th percentile
Healthy weight	5th percentile to less than the 85th percentile
Overweight	85th to less than the 95th percentile
Obese	Equal to or greater than the 95th percentile



# Nutritional Assessment of Adolescents

- Nutrition screening should include at least a brief dietary assessment.
  - Food frequency questionnaires
  - 24-hour recalls
  - food diaries or food records
- There are rapid assessment questionnaires and screening tools can be completed quickly and may be used to identify those adolescents in need of additional dietary assessment and nutrition counseling

**Table 14.12** Strengths and limitations of various dietary assessment methods used in clinical settings

	Strengths	Limitations	Applications
24-Hours Recall	<ul style="list-style-type: none"> <li>• Does not require literacy</li> <li>• Relatively low respondent burden</li> <li>• Data may be directly entered into a dietary analysis program</li> <li>• May be conducted in person or over the telephone</li> </ul>	<ul style="list-style-type: none"> <li>• Dependent on respondent's memory</li> <li>• Relies on self-reported information</li> <li>• Requires skilled staff</li> <li>• Time consuming</li> <li>• Single recall does not represent usual intake</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate for most people as it does not require literacy</li> <li>• Useful for the assessment of intake of a variety of nutrients and assessment of meal patterning and food group intake</li> <li>• Useful counseling tool</li> </ul>
Food Frequency	<ul style="list-style-type: none"> <li>• Quick, easy, and affordable</li> <li>• May assess current as well as past diet</li> <li>• In a clinical setting, may be useful as a screening tool</li> </ul>	<ul style="list-style-type: none"> <li>• Does not provide valid estimates of absolute intake of individuals</li> <li>• Can't assess meal patterning</li> <li>• May not be appropriate for some population groups</li> </ul>	<ul style="list-style-type: none"> <li>• Does not provide valid estimates of absolute intake for individuals, thus of limited usefulness in clinical settings</li> <li>• May be useful as a screening tool; however, further development research is needed</li> </ul>
Food Record	<ul style="list-style-type: none"> <li>• Does not rely on memory</li> <li>• Food portions may be measured at the time of consumption</li> <li>• Multiple days of records provide valid measure of intake for most nutrients</li> </ul>	<ul style="list-style-type: none"> <li>• Recording foods eaten may influence what is eaten</li> <li>• Requires literacy</li> <li>• Relies on self-reported information</li> <li>• Requires skilled staff</li> <li>• Time consuming</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate for literate and motivated population groups</li> <li>• Useful for the assessment of intake of a variety of nutrients and assessment of meal patterning and food group intake</li> <li>• Useful counseling tool</li> </ul>
Diet History	<ul style="list-style-type: none"> <li>• Able to assess usual intake in a single interview</li> <li>• Appropriate for most people</li> </ul>	<ul style="list-style-type: none"> <li>• Relies on memory</li> <li>• Time consuming (60 to 90 minutes)</li> <li>• Requires skilled interviewer</li> </ul>	<ul style="list-style-type: none"> <li>• Appropriate for most people as it does not require literacy</li> <li>• Useful for assessing intake of nutrients, meal patterning, and food group intake</li> <li>• Useful counseling tool</li> </ul>

# Nutrition risk indicators

- Table 14.13 p( 374-376 )

# Nutrition Education and Counseling

- It is also important to not provide nutrition education messages or materials that are **too childish**
- Adolescents require a unique approach to education and counseling

# Nutrition Education and Counseling

1. **getting to know** the adolescent, including personal health or nutrition-related concerns.
2. provide an **overview of the events of the counseling session**, including which specific nutrition topics will be discussed
3. the adolescent should be encouraged **to add his or her own nutrition concerns** to the list of topics to be discussed
4. complete **nutrition assessment** should be performed
5. the counselor and teen should work **together to establish goals** for improving dietary intake and reducing nutrition risk

# Nutrition Education and Counseling

- **Involve** the adolescent in **decision making** processes during nutrition counseling
- Behavior change is more likely when the adolescent has **suggested ways to change**, thus becoming engaged in the education process and owning a willingness to change

# Nutrition Education and Counseling

- **One or two goals** during a counseling session :  
with suggesting ways to accomplish them
- **Electronic communications** methods such as  
text messaging, podcasts, YouTube, and online  
social networking sites

# Physical Activity and Sports

- **Physical activity** is any bodily movement produced by skeletal muscles which results in energy expenditure
- **Physical activity** is distinguished from **exercise**, which is a subset of physical activity that is planned, structured, and repetitive and is done to improve or maintain physical fitness
- Associated with both **physiological** and **psychological** benefits, especially during adolescence



# Physical Activity and Sports

- It is recommended that adolescents engage in 60 minutes or more of physical activity at least 3 days of the week
- Females are less active than males
- **High levels of physical activity** combined with **growth and development**, increase adolescents' needs for energy, protein, and selected vitamins and minerals
  - Page 379

# Physical Activity and Sports

- Competitive athlete may require additional 500-1500 calories per day to meet their needs
- Monitor weight change before and after training
- If weight loss is not transient → the caloric intake is inadequate to support growth and development
- Vegetarians !!
- Page 380