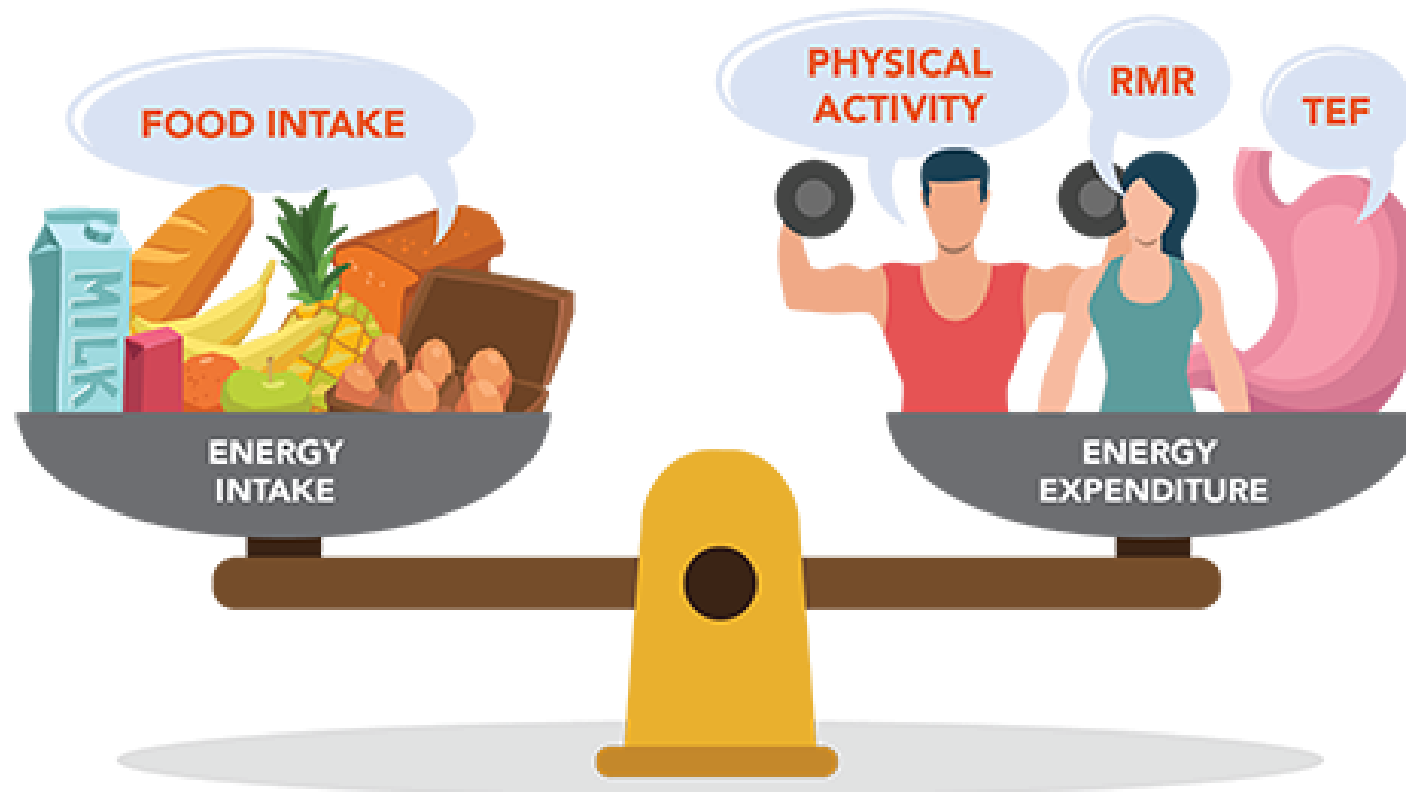


Energy Balance & Eating Disorder



Learning Objectives

At the end of the class, students should be able to:

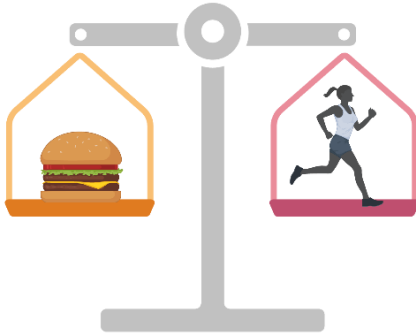
- Define energy balance and their contribution to weight gain or weight loss
- State component that influence energy intake and expenditure
- Calculate Basal Metabolism Rate (BMR)
- Explain factors affecting BMR
- Calculate body mass index (BMI), estimate total energy requirement based on physical activity.
- Differentiate types of eating disorder.

Energy Balance

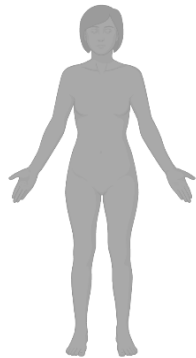
- Relationship between energy in (food consumption) and energy out (physical activity).
- State where the energy intake consumed through food equals to the energy expenditure.
- Positive balance - energy intake from food exceeds energy expenditure from activity = Weight gain.
- Negative balance - energy expenditure from physical activity exceeds food intake = Weight loss.

Energy Balance

Balanced state

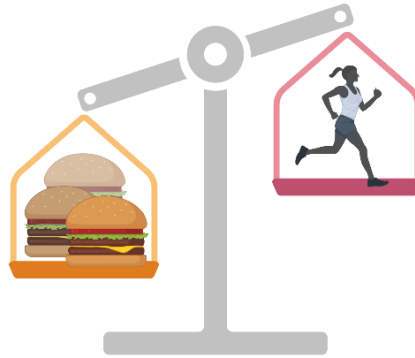


Calories in = calories out

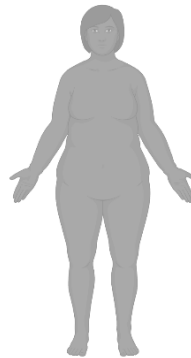


Stable body weight

Positive energy balance

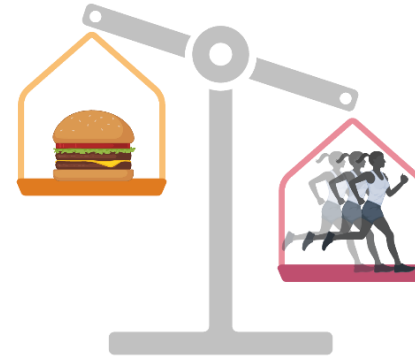


Calories in > calories out

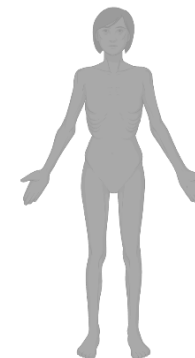


Weight gain

Negative energy balance



Calories in < calories out



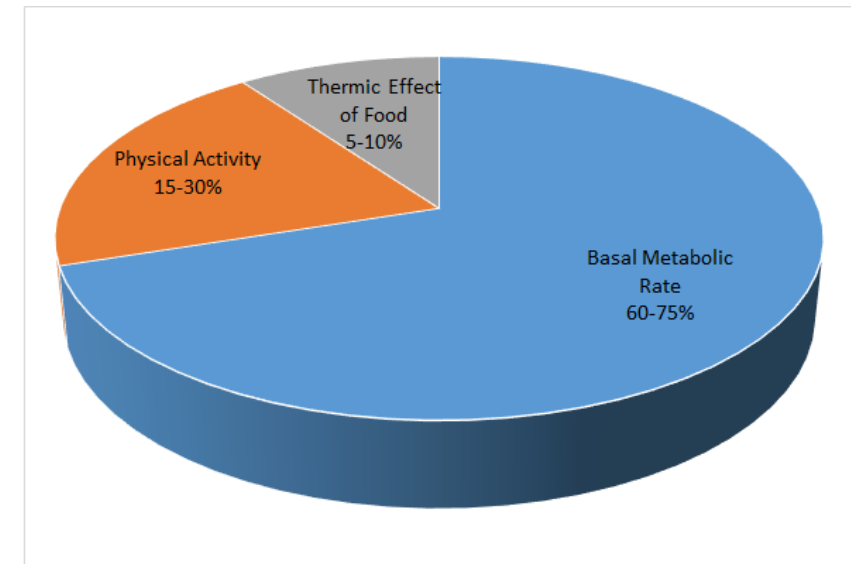
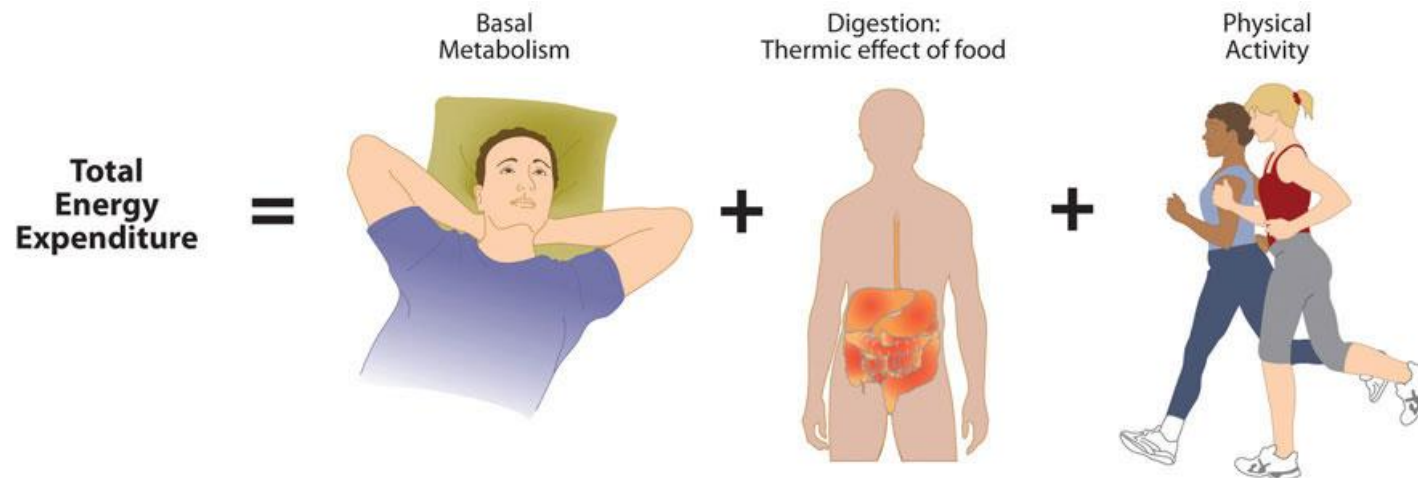
Weight loss

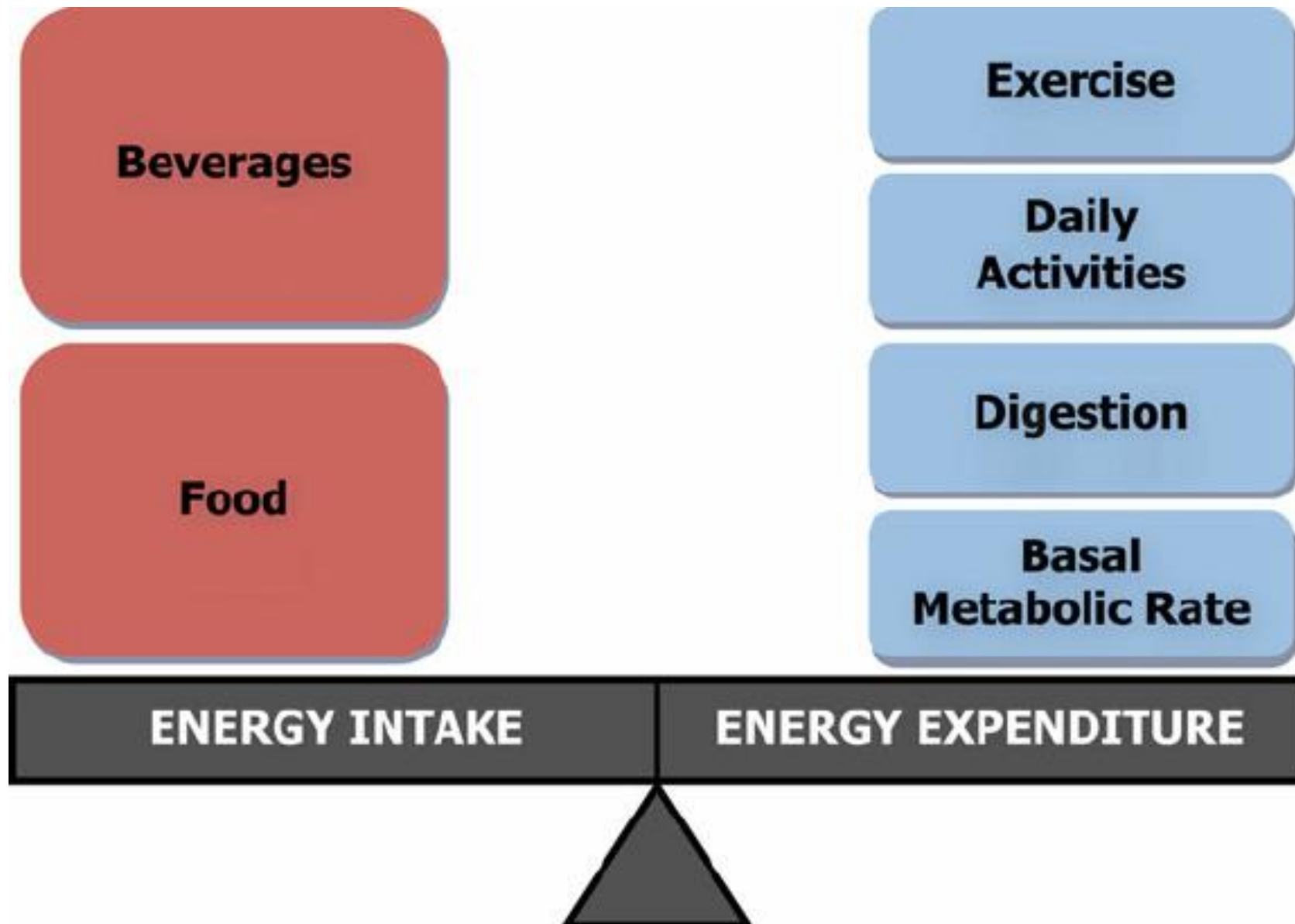
Energy Intake

- Total amount of energy (calories) obtain from the food.
- Depends on the amount and kind of food eaten.
- Food intake is regulated by:
 - ☐ Hunger
 - ☐ Appetite
 - ☐ Satiation
 - ☐ Satiety

Energy Expenditure

- Total amount of energy uses by the body for all activities.
- Depends on:
 - ✓ Basal Metabolism
 - ✓ Physical activity
 - ✓ Thermic effect of food





Basal Metabolic Rate (BMR)

- The amount of energy body needs to perform basic life-sustaining functions (breathing, circulating blood, and regulating body temperature) while at rest.
- It's the energy body uses just to stay alive when person not doing any physical activities.
- Factors Affecting BMR:
 - **Age**: BMR decreases with age.
 - **Gender**: Men typically have a higher BMR than women due to more muscle mass.
 - **Body Composition**: Muscle burns more calories than fat, so people with more muscle tend to have a higher BMR.
 - **Hormones**: Thyroid hormones, for example, affect how fast the body uses energy.
 - **Genetics**: Some people naturally have higher or lower BMRs.

TABLE 8-1**Factors That Affect the BMR**

Factor	Effect on BMR
Age	Lean body mass diminishes with age, slowing the BMR. ^a
Height	In tall, thin people, the BMR is higher. ^b
Growth	In children and pregnant women, the BMR is higher.
Body composition (gender)	The more lean tissue, the higher the BMR (which is why males usually have a higher BMR than females). The more fat tissue, the lower the BMR.
Fever	Fever raises the BMR. ^c
Stresses	Stresses (including many diseases and certain drugs) raise the BMR.
Environmental temperature	Both heat and cold raise the BMR.
Fasting/starvation	Fasting/starvation lowers the BMR. ^d
Malnutrition	Malnutrition lowers the BMR.
Hormones (gender)	The thyroid hormone thyroxine, for example, can speed up or slow down the BMR. ^e Premenstrual hormones slightly raise the BMR.
Smoking	Nicotine increases energy expenditure.
Caffeine	Caffeine increases energy expenditure.
Sleep	BMR is lowest when sleeping.

Calculate of Basal Metabolic Rate (BMR)

Mifflin-St Jeor Equation (more accurate for most people)

For men:

$$BMR = 10 \times \text{weight (kg)} + 6.25 \times \text{height (cm)} - 5 \times \text{age (years)} + 5$$

For women:

$$BMR = 10 \times \text{weight (kg)} + 6.25 \times \text{height (cm)} - 5 \times \text{age (years)} - 161$$

Example

- Calculate BMR for a 30-year-old woman who weight 70 kg and 165 cm tall.

$$\text{BMR} = 10 \times 70 + 6.25 \times 165 - 5 \times 30 - 161$$

$$\begin{aligned}\text{BMR} &= 700 + 1,031.25 - 150 - 161 \\ &= 1,420.25 \text{ calories/day}\end{aligned}$$

So, her BMR is **1,420.25 calories per day**.

Thermic Effect of Food (TEF)

- Extra energy for digestion, absorption and transport is required after eating.
- 5% - 10% of the body's total energy needs for metabolism relate to the processing of food.

$$\text{TEF} = \text{Total Daily Energy Expenditure (TDEE)} \times 10$$

Physical Activity

- Energy used during physical activity
- The activity factor for physical activity is used to estimate how many calories burn based on your activity level.
- This factor used to calculate Total Daily Energy Expenditure (TDEE).

Level of physical activity	Activity factor
Sedentary (little or no exercise)	1.200
Lightly active (light exercise/sports 1–3 days/week)	1.375
Moderately active (moderate exercise/sports 3–5 days/week)	1.550
Very active (hard exercise/sports 6–7 days/week)	1.725
Extra active (hard daily exercise/sports and a physical job, or training twice daily)	1.900

Total Daily Energy Expenditure (TDEE)

- The total number of calories burn in a day (including all activities, exercise, and basic body functions, BMR)

$$\text{TDEE} = \text{BMR} \times \text{Activity Factor}$$

Example: A 30-year-old woman weighs 70 kg and is 165 cm tall. She is moderately active, meaning she exercises or participates in sports about 3 to 5 days a week. Calculate her Total Daily Energy Expenditure (TDEE).

Total Daily Energy Expenditure (TDEE)

$$\begin{aligned}\text{BMR} &= (10 \times 70) + (6.25 \times 165) - (5 \times 30) - 161 \\ &= 1,420.25 \text{ calories per day.}\end{aligned}$$

$$\begin{aligned}\text{TDEE} &= 1,420.25 \times 1.55 \\ &= 2,205.39 \text{ calories/day.}\end{aligned}$$

Weight Maintenance: If you consume the same number of calories as your TDEE, your weight will remain stable.

Weight Loss: To lose weight, you would need to consume fewer calories than your TDEE, creating a calorie deficit.

Weight Gain: To gain weight, you would need to consume more calories than your TDEE, creating a calorie surplus.

Weight Gain or Weight Loss

1. For Weight Loss:

- A common guideline is to cut 500-750 calories per day from TDEE to lose about 0.5 to 1 kg per week.
- ❑ 500-calorie deficit = Lose about 0.5 kg per week.
- ❑ 750-calorie deficit = Lose about 0.75-1 kg per week.

For example, if your TDEE is 2,500 calories:

To lose weight, you could aim for 2,000 calories/day (500-calorie deficit).

2. For Weight Gain:

- A typical surplus is 250-500 extra calories per day.
- ❑ 250-calorie surplus = Slow and steady weight gain (muscle).
- ❑ 500-calorie surplus = Faster weight gain (might include fat as well).

For example, if your TDEE is 2,500 calories:

To gain weight, you could aim for 2,750-3,000 calories/day.

Energy Requirement

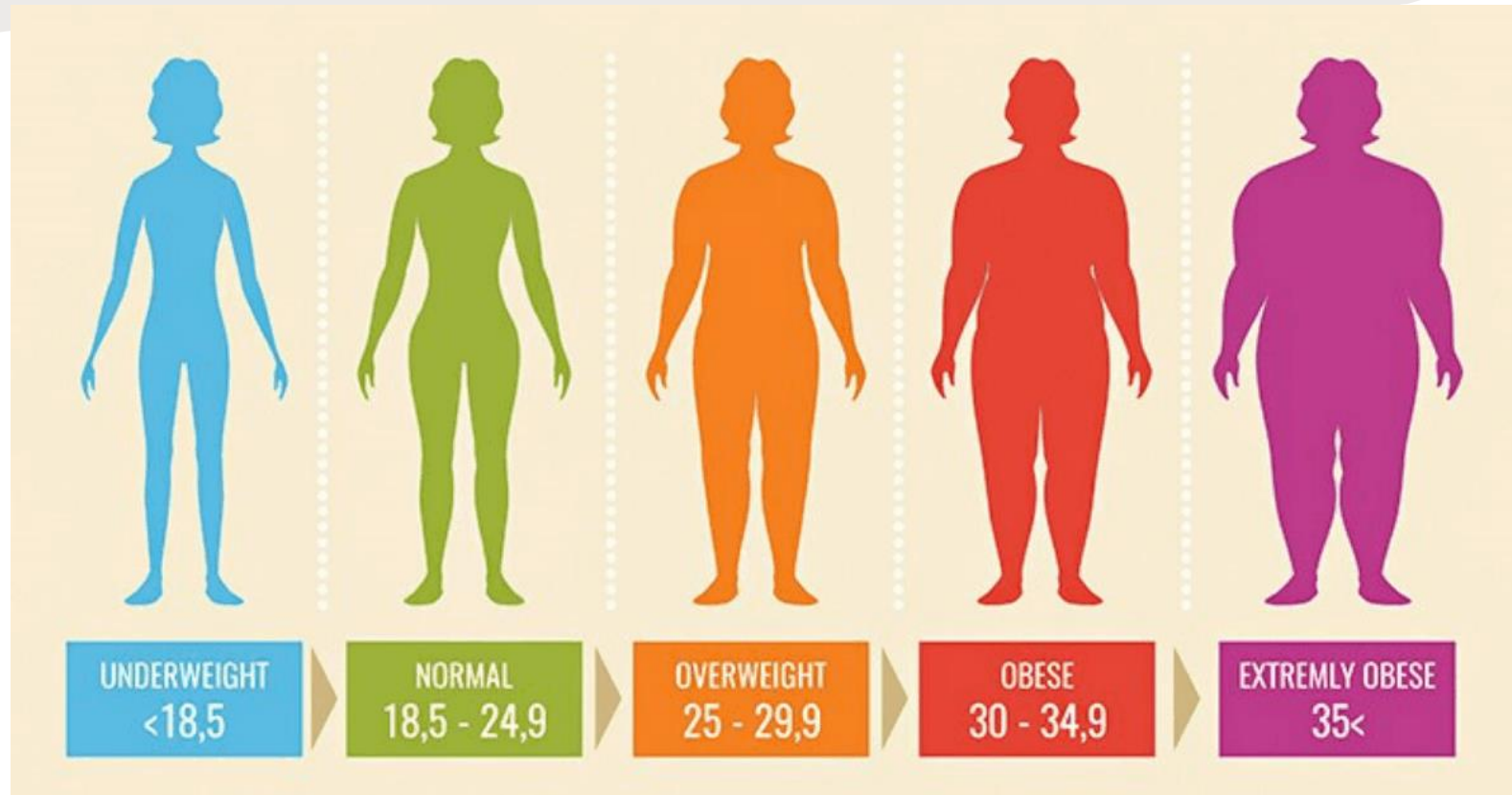
- Energy needs are determined by energy expenditure.
- Total energy requirement = BMR + Physical Activity + Thermic Effect of Food.
- Energy requirements vary based on factors like:
 - 1.**Age** – Younger people typically need more energy for growth and development.
 - 2.**Sex** – Men usually require more energy than women due to having more muscle mass.
 - 3.**Body size and composition** – Larger individuals or those with more muscle mass have higher energy needs.
 - 4.**Physical activity level** – People who are more active or engage in regular exercise will need more calories.
 - 5.**Health status** – Certain conditions, like pregnancy or illness, can increase energy needs

Body Mass Index (BMI)

- Measure of body fat based on height and weight that applies to both adult men and women.

$$\text{BMI} = \frac{\text{Weight in kilogram}}{(\text{Height in meter})^2}$$

Body Mass Index (BMI)



Example

Aisha is a 26-year-old girl who weighs 60kg and height is 166cm. Determine Aisha's BMI categories.

$$\text{BMI} = \text{weight (kg)} / \text{height}^2 (\text{m}^2)$$

$$= 60 \text{ kg} / (1.66\text{m} \times 1.66\text{m})$$

$$= 21.77$$

BMI = Normal categories

Eating Disorder

- A mental health condition characterized by abnormal eating habits that negatively impact physical health, emotional well-being, and social functioning.
- Individuals with eating disorders often have distorted perceptions of body image.
- Involve either excessive eating (binge eating) or extreme restrictions (anorexia)
- Without treatment eating disorders lead to mood swings, physical problems, and potential death.

Eating Disorder

Common types of eating disorders include:

1. Anorexia Nervosa
2. Bulimia Nervosa
3. Binge Eating Disorder (BED)

Anorexia Nervosa

- Serious eating disorder characterized by self-imposed starvation and excessive weight loss, driven by an intense fear of gaining weight and a distorted body image.
- Often see themselves as overweight, even when they are dangerously underweight.
- Key Features of Anorexia Nervosa
 - ❖ Severe Food Restriction
 - ❖ Intense Fear of Weight Gain
 - ❖ Perceive themselves as overweight, even though they are dangerously thin
 - ❖ Excessive Exercise



Anorexia Subtype

1. Restricting type

- Lose weight by cutting out sweet and fattening snacks, eventually eliminating nearly all food
- Show no variability in diet

2. Binge-eating/purging type

- Lose weight by forcing themselves to vomit after meals or abusing laxatives or diuretics

Sign & Symptoms of Anorexia Nervosa

Physical	Psychological	Behavioral
<ul style="list-style-type: none">• Dramatic weight loss or failure to gain weight• Thin appearance, with prominent bones, lack of muscle tone, and pale skin.• Low blood pressure or slow heart rate.• Hair thinning or hair loss• Brittle nails and dry, flaky skin.• Amenorrhea (absence of menstruation).	<ul style="list-style-type: none">• Intense preoccupation with food, body size, and weight.• Fear of eating in public or around others.• Extreme dieting, counting calories, or following rigid food rituals.• Perfectionism and a need for control.• Depression, anxiety, or mood swings.	<ul style="list-style-type: none">• Avoidance of social situations involving food.• Engaging in binge-purge behaviors, which may include vomiting or excessive exercise• Wearing loose clothing to hide their body shape.

Bulimia Nervosa

- An eating disorder characterized by a person consumes an excessive amount of food in a short period, followed by purging/non purging behaviors to avoid weight gain.
- Two subtypes:
 - **Purging type:** This kind of bulimia refers to those who will engage in **self-induced vomiting** or **the excessive abuse of diuretics and laxatives**.
 - **Non-Purging type** : This kind of bulimia refers to the person using other compensatory methods to offset the effects of episodes of bingeing, these include **fasting** or **excessive exercise**.

Bulimia Nervosa Characteristics

- Eats an excessive amount of food in a short amount of time, often far beyond what most people would eat during a meal.
- Individuals report feeling unable to stop eating during the binge.
- Feelings of guilt and shame after the binge
- Binge eating episodes are often done in private and hidden from others, as the individual feels embarrassed or ashamed about their eating behavior.



Sign & Symptoms of Bulimia Nervosa

- Frequent Weight Fluctuations
- Dry skin, dry mouth, and thirst can result from purging behaviors
- severe imbalance of sodium, potassium, and calcium can occur, especially when vomiting or using laxatives frequently
- Repeated vomiting can lead to swelling of the salivary glands, causing noticeable puffiness in the cheeks or jaw area.
- Afraid of gaining weight
- Poor self-esteem
- Depression and Anxiety

BULIMIA VS ANOREXIA

SYMPTOMS	BULIMIA	ANOREXIA
FEAR OF WEIGHT GAIN	✓	✓
BODY DISSATISFACTION	✓	✓
CALORIC RESTRICTION		✓
MALNUTRITION	✓	✓
BINGE EATING	✓	
WEIGHT FLUCTUATIONS	✓	
DENIAL	✓	✓
RESTRICTIVE FOOD INTAKE		✓



Binge Eating Disorder

- Frequent episodes of binge eating involving the consumption of a large amount of food in a short period of time.
- Binge episodes will be accompanied by a loss of control over eating and the inability to stop the binge.
- These binge eating episodes occur **without purging** behaviors.
- Feelings of guilt and shame about the amount of food consumed during a binge episode and the way it has been eaten.
- Often occurs at times of stress, anger, boredom or distress, and at these times may be a means of coping with challenging emotions.

Sign and Symptoms of Binge Eating

- Eating late at night
- Hiding food around the home, anticipating the binge
- Constant weight fluctuations
- Sexual avoidance, Avoids many social situations
- Exhibits an abnormally low self-esteem
- Disgust and shame after overeating
- Depressed and anxious mood



