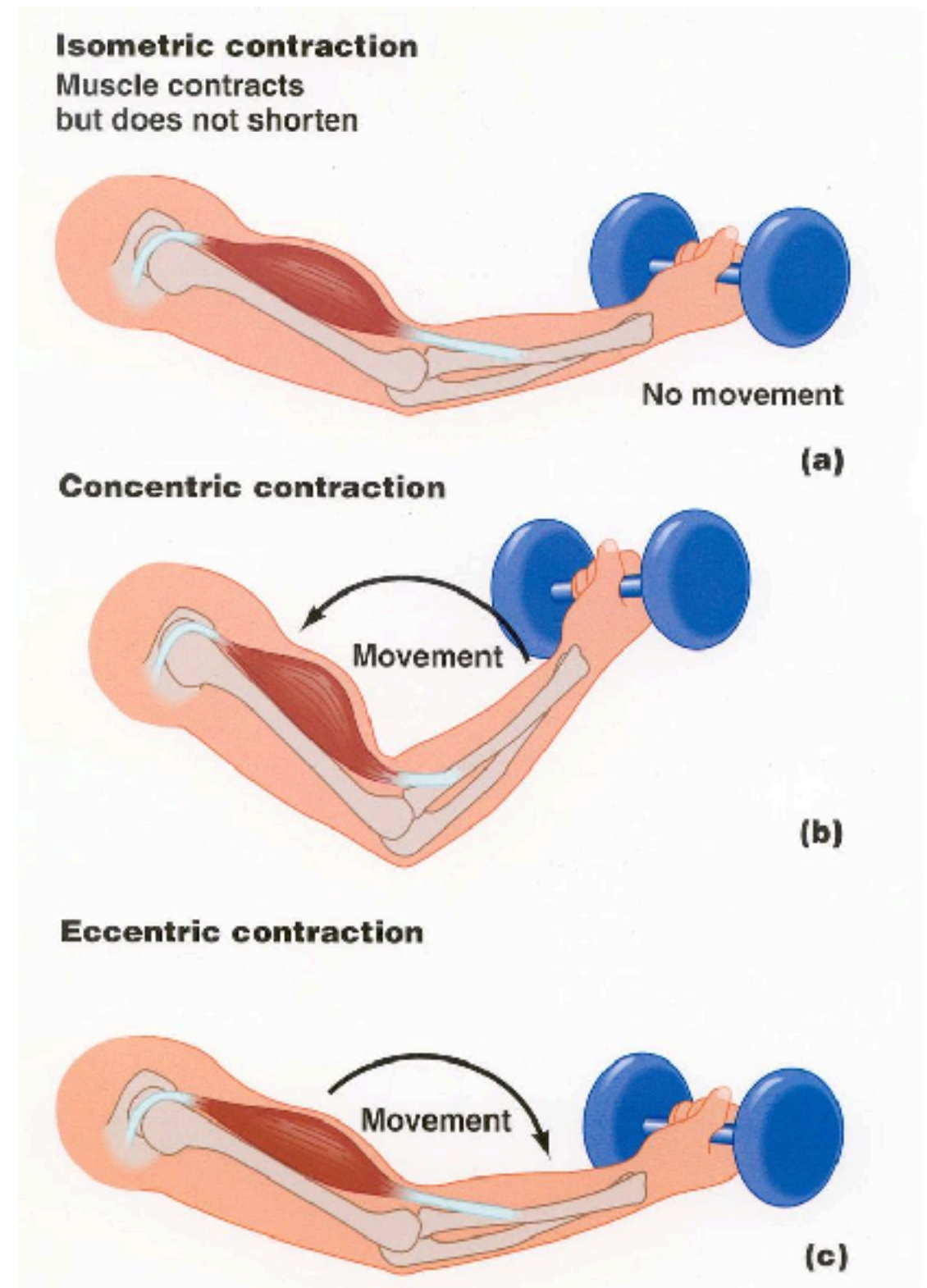


Types of Muscle Movement:

- ◆ Concentric:
 - ❖ Muscle fibres shorten
- ◆ Eccentric:
 - ❖ Muscle fibres lengthen
- ◆ Isometric:
 - ❖ Muscle fibres do not change in length



Muscle Fibres and Energy Systems

ATP=ENERGY

Slow-Twitch vs. Fast-Twitch Muscles

- ◆ Slow-twitch muscle fibres:
 - ❖ Most active during: long-distance running, swimming, and cycling
 - ❖ Red or dark in colour
 - ❖ Generate and relax tension slowly; able to maintain a lower level of tension for long durations

- ◆ Fast-twitch muscle fibres:
 - ❖ Ideal for: short sprints, powerlifting, and explosive jumping
 - ❖ Pale in colour
 - ❖ Ability to tense and relax quickly; generate large amounts of tension with low endurance levels

Three Fibre Types

- ◆ *Type I or Slow-Oxidative (SO)*
 - ❖ Generate energy slowly
 - ❖ Fatigue-resistant
 - ❖ Depend on aerobic processes
 - ◆ *Type IIA or Fast-Oxidative Glycolytic (FOG)*
 - ❖ Intermediate-type muscle fibres
 - ❖ Allow for high-speed energy release
 - ◆ *Type IIB of Fast-Glycolytic (FG)*
 - ❖ Store glycogen and high levels of enzymes
 - ❖ Allow for quick contraction without the need for oxygen
- ❖ THESE FIBRE TYPES REQUIRE DIFFERENT TYPES OF ENERGY!

“2” Energy Systems/Three Energy Systems

- ◆ *Anaerobic System (2 DIFFERENT TYPES, ALATIC AND LACTIC)*
 - ❖ Without the use of oxygen (O_2)
 - ▶ None of its metabolic activity will involve O_2
 - ❖ Utilizes chemicals and enzymes; occurs in the muscle fibre
 - ❖ Short-lived

- ◆ *Aerobic System*
 - ❖ In the presence of oxygen (O_2)
 - ▶ All of its metabolic activity will involve O_2
 - ❖ Occurs in the mitochondria of cells
 - ❖ Leads to the complete breakdown of glucose

HOWEVER, these are “in use” at the same time, which looks like 3 different systems.

The Role of Energy Systems

The three energy systems available to allow for muscle function:

- Anaerobic alactic
- Anaerobic lactic
- Aerobic
 - Each system has certain limitations and strengths
 - Training can be incorporated to either enhance one or all energy systems, depending on the athlete's needs

Anaerobic Alactic Energy System

- First of 2 Anaerobic Energy Pathways
- Relies on Stored ATP (Energy) for 10-15 Seconds
- High speed explosive movements, generally 85%-100% of maximal intensity
- High intensity and volume training
- No by-product
- Training prescription will depend greatly on the athlete's level of fitness, athletic aspirations, and type of sport

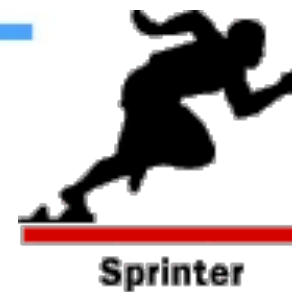
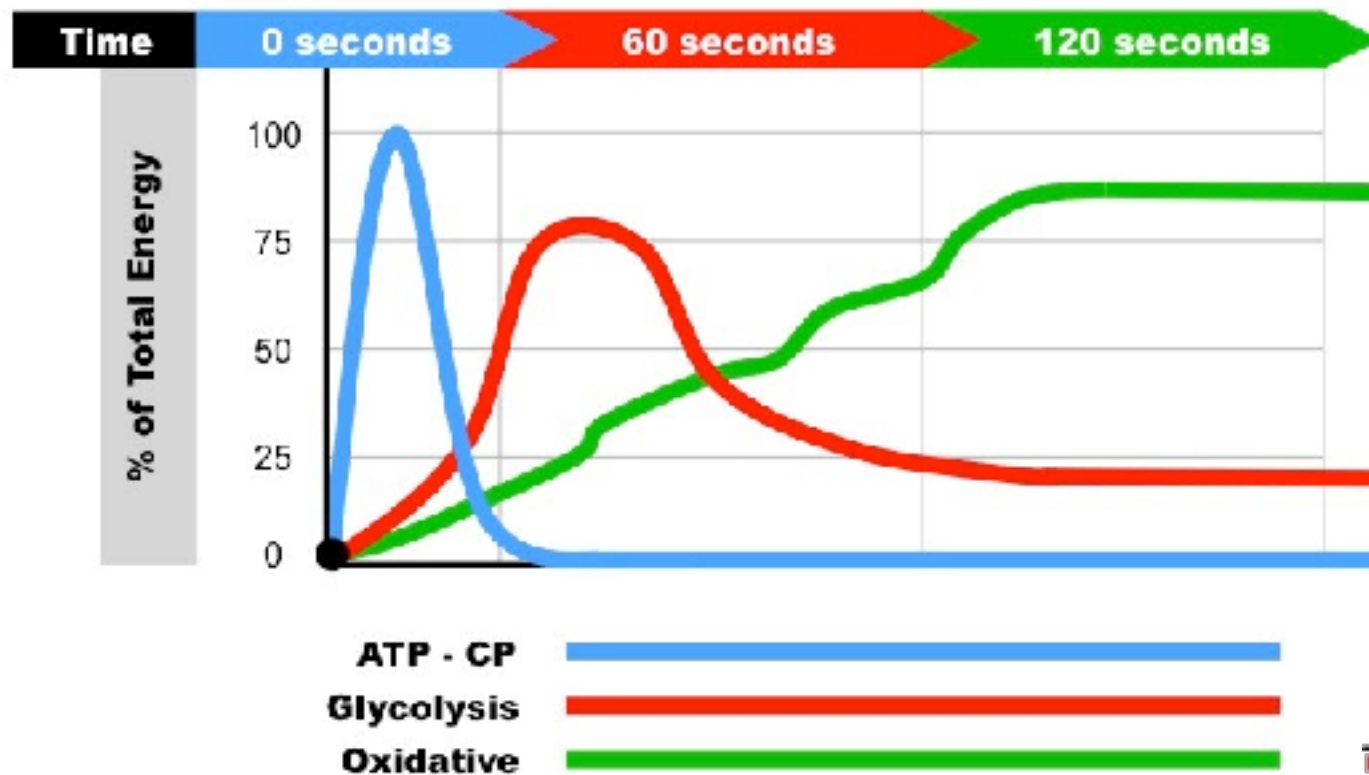
Anaerobic Lactic Energy System

- Second Anaerobic energy system, provide additional 1-3 Minutes of Energy
- Uses glucose/glycogen (carbohydrates) to make ATP
- By-product=lactic acid, which causes?
- Moderately high intensity and volume training
- Training prescription will depend greatly on the athlete's level of fitness, athletic aspirations, and type of sport

Aerobic System

- Repetitive movements, generally 50%-75% of maximal intensity
- Short rest periods between sets
- Moderately low intensity and volume training
- Training prescription will depend greatly on the athlete's level of fitness, athletic aspirations, and type of sport

Energy Sources for Different Sports



Phosphagen system

8-10 seconds (100 m)



Glycogen-lactic acid system

1.3-1.6 minutes (400 m)



Aerobic respiration

Unlimited time (15 Km)

Training Principles and Methods

Why do we Train?

- Makes the body more efficient
- Makes the body better able to perform certain tasks
- Can make the human machine more effective
- We can run faster, jump higher, and throw further

F.I.T.T. Principle

- The four building blocks of exercise prescription
- F = Frequency
- I = Intensity
- T = Type
- T = Time

Frequency

- the amount of time per week spent training
- general guideline is 3-5 times/week
- determination of frequency depends greatly on the athlete's level of fitness, athletic aspirations, and type of training

Intensity

- how hard the individual must work
- taken as a percentage of the individual's maximal aerobic and anaerobic power
- general guideline is 50%-100% of athlete's maximal intensity

Time

- amount of time spent in a single training session
- general guideline is 3-6 times/week
- depends on the athlete's level of fitness, athletic aspirations, and type of training

Type

- either aerobic or anaerobic training prescriptions, or a combination of both
- depends on the athlete's level of fitness, athletic aspirations, and sport or activity for which he or she is training

Concurrent

- Training all energy systems at the same time
- Different types of training simultaneously
- Great for general fitness
- Performed during the off-season for certain athletes
- Ideal for keeping variety in one's exercise program

Interval

- Can benefit both anaerobic and aerobic systems
- Alternating periods of intensity within a given workout
- Great for lactic acid training threshold
- Manipulates length of intense period, its intensity, length of rest, and number of repetitions

Performance Nutrition

Feeding your body: Energy Nutrients



PROTEIN



CARBS



FATS

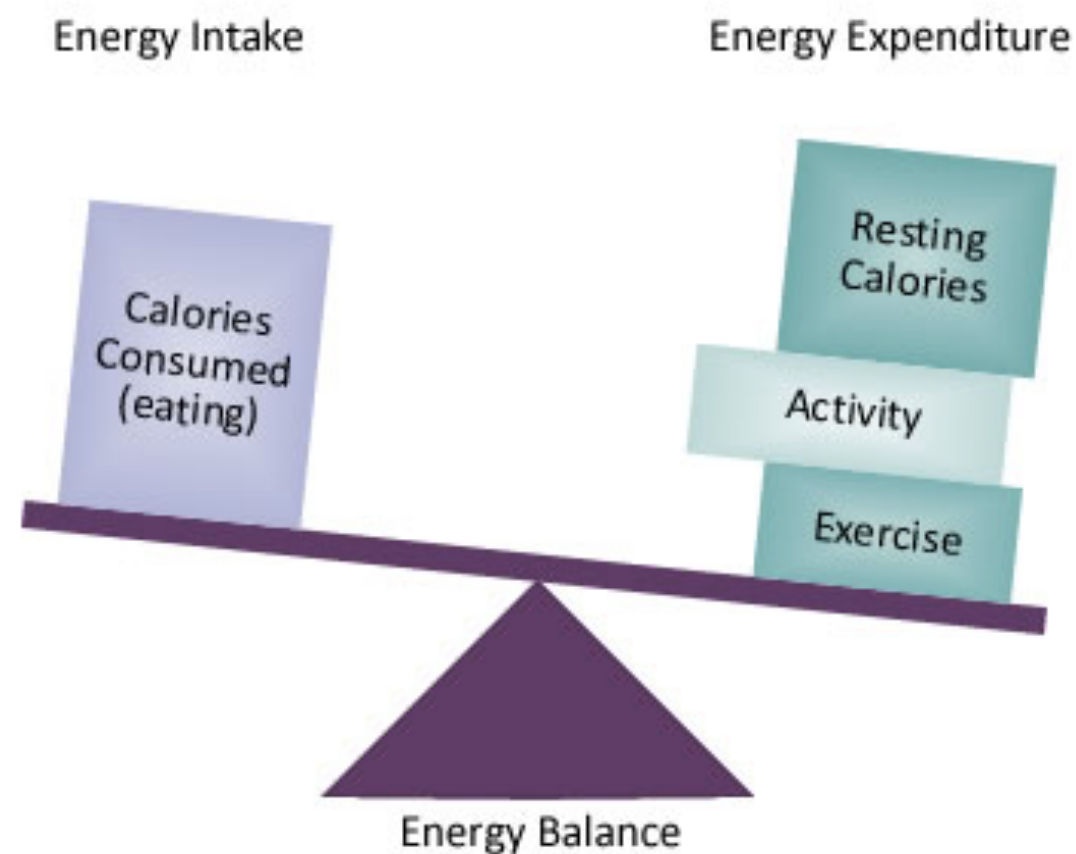
The Role of Carbohydrates

- ♦ Carbohydrates are the most abundant organic substances in nature, and they are essential for human and animal life.
- ♦ Preferred by body for many functions

Compare energy sources	
Energy Source	Calories per gram
Fats	9
Proteins	4
Carbohydrates	4

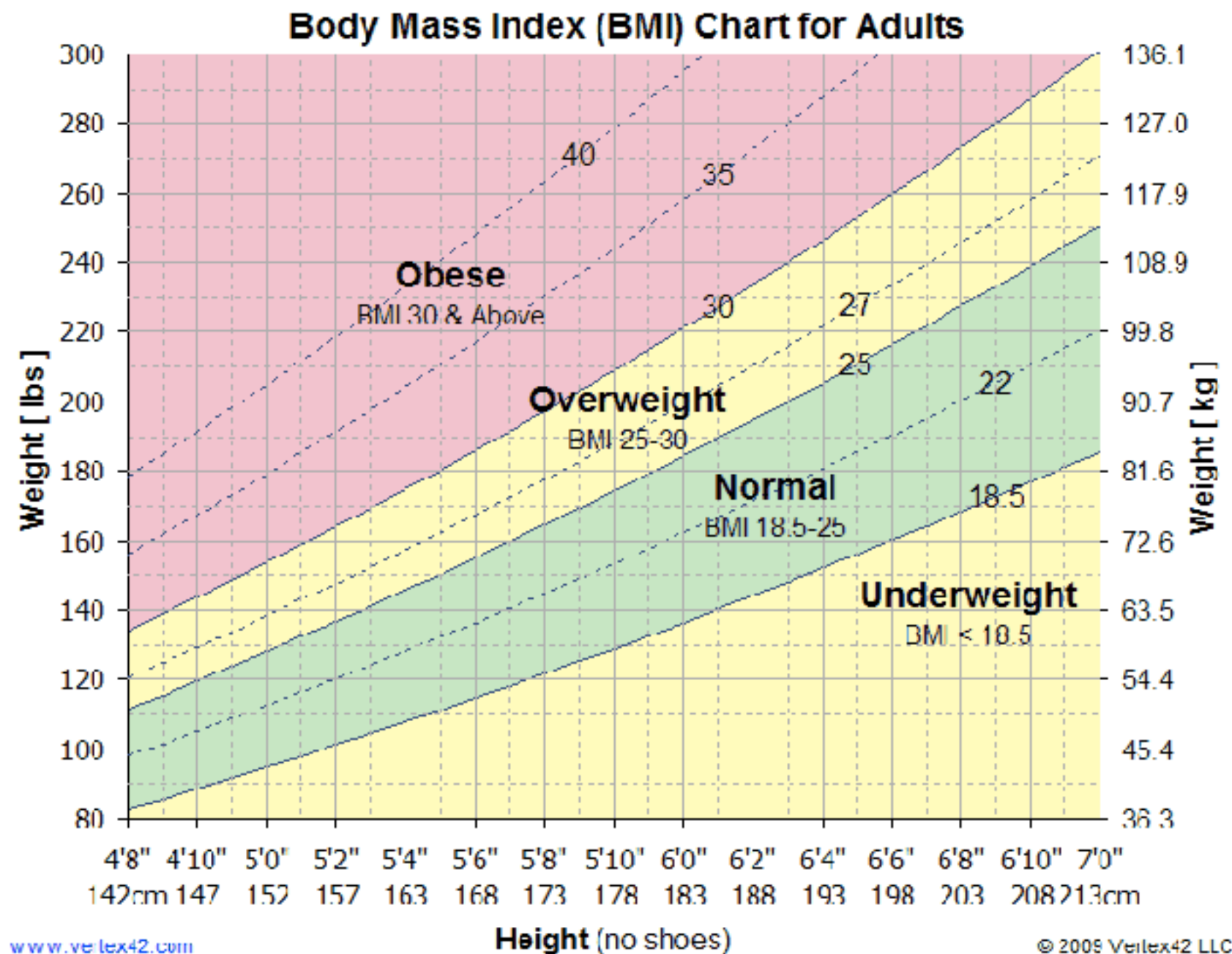
The Energy Equation

- ♦ *Energy equation*: the food (or energy) we take in should closely match the effort we put out
 - ♦ *OTHERWISE?*
- ♦ *Energy storage = Energy intake – Energy output*



Body Mass Index

- ♦ **Body Mass Index (BMI):**
 - ❖ Used to assess extent to which a person is balancing the energy equation
 - ❖ Ratio of a person's weight in kilograms to the square of his/her height in metres
 - ❖ Correlates with increased risks of disease
 - ❖ **Does not distinguish between fat and excess muscle**
 - ❖ Is everyone who is "obese" actually obese?



Obesity

- ♦ *Obesity* is considered a “chronic” condition - leading to other illnesses
- ♦ Contributing factors include:
 - ❖ Activity levels
 - ❖ Diet
 - ❖ Genetic factors
 - ❖ Rates of metabolism
 - ❖ Environmental, social, and psychological factors
- ♦ National Institute on Nutrition (Canada) reports there is an 80% chance that a child will become obese if both parents are also obese
- ♦ 20% of Canadians over 18 are obese (up from 15% over 8 years).

Being Underweight

- ♦ Being *underweight* (officially designated as a BMI of less than 18.5) is a major health concern
- ♦ One prominent factor associated with being underweight includes a relentless urge for an impossibly lean physique
- ♦ Signs suggestive of an eating disorder include:
 - ❖ Preoccupation with food and weight
 - ❖ Eating alone
 - ❖ Continuous drinking of diet soda and water
 - ❖ Trips to the bathroom during or immediately following meals
 - ❖ Use of laxatives
 - ❖ Compulsive/excessive exercise
 - ❖ Increasing criticism of one's body
 - ❖ Expressed concerns about being fat

Nutrition and Athletic Performance

Food Group	Athlete 1 (divers, synchronized swimmers, and gymnasts)	Athlete 2 (most athletes)	Athlete 3 (endurance athlete)
Grain Products	Minimum 5 servings	8 servings or more	10–12 servings or more
Vegetables and Fruit	Minimum 5 servings	8 servings or more	8–10 servings or more
Meat and Alternatives	Minimum 2 servings	2 servings	2–4 servings
Milk and Alternatives	Minimum 2 servings (teens 3–4 servings)	2 servings (teens 3–4 servings)	2–6 servings (teens 3–6 servings)
Extra Foods	Minimize extra choices	Choose in moderation	Choose to meet energy needs

Source: Sport Nutrition for the Athletes of Canada

Fluid Replacement

- ♦ Before exercise:
 - ❖ Drink 2–3 cups of water 2–3 hours before exercise
 - ❖ Drink 1 cup of water 10–20 minutes before exercise
- ♦ During exercise:
 - ❖ Drink 1/2 cup of cool fluid after each 10 minutes of exercise
 - ❖ Drink a sports beverage (6–8% concentration of carbohydrate) during activity longer than 50 minutes
- ♦ After exercise:
 - ❖ Regained fluid loss within 2 hours
 - ❖ Drink fluids containing carbohydrates to rebuild glycogen store and electrolytes