Module 2: Metabolic Syndrome & Sarcopenia
What You Will Learn

• Sarcopenia
• Metabolic Syndrome
Sarcopenia

• Term utilized to define the loss of muscle mass and strength that occurs with aging

• Progressive muscle wasting occurs with aging

• Persons who are obese and sarcopenic (the “fat frail”) have worse outcomes than those who are sarcopenic and non-obese

• Decreased physical activity with aging appears to be the key factor involved in causing sarcopenia

• Loss of muscle strength may be more important than loss of muscle mass in preventing frailty and age-related conditions
Sarcopenic Obesity

• An increase in fat mass and a decrease in lean muscle mass
• The impact of obesity on sarcopenia is only now emerging as an important public health problem
• “Fat frail” have the worst of both worlds as they age – increased weakness due to sarcopenia and a need to carry greater weight due to obesity
• Why is this important?
• LIFESTYLE CHANGES = PREVENTION = HEALTHY AGING!!!
Metabolic Syndrome

• A name for a group of risk factors that occur together and increase the risk for coronary artery disease and type II diabetes
• Researchers are not sure whether the syndrome is due to one single cause, but all of the syndrome's risk factors are related to obesity
• Metabolic syndrome is associated with many conditions and risk factors. Two most important risk factors are:
  • 1. Extra weight around the middle of the body (central obesity)
  • 2. Insulin resistance, where the body cannot use insulin effectively
Metabolic Syndrome

- According to the American Heart Association and the National Heart, Lung and Blood Institute, metabolic syndrome is present if you have three or more of the following signs:
  - Fasting plasma glucose level of >6.1 mmol/L (CA) >100 mg/dL (5.6 mmol/L) or higher
  - Triglyceride level of ≥1.69 mmol/L (CA) ≥150 mg/dL (1.7 mmol/L)
    HDL cholesterol level for men of <1.04 mmol/L and for women of <1.29 mmol/L (CA) <40 mg/dL (1.04 mmol/L) in men or <50 mg/dL (1.3 mmol/L)
    Blood pressure of ≥130/85 mm Hg (CA) ≥130/85 mm Hg
  - Waist circumference for men of >102 cm (40 inches) and for women of >88 cm (35 inches)
Metabolic Syndrome Study

• Metabolic Syndrome in a Family Practice Study – http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1781502/

• 501 men and women between 40 and 60 years old registered at the Family Medicine Centre (Kingston ON, Queens University)

• Based on the number of risk factors for metabolic syndrome recorded on their charts (except for waist circumference), participants were stratified into 3 groups.

• Group 1 were patients without syndrome (0 or 1 risk factor).

• Group 2 were patients who might have syndrome, depending on measurement of waist circumference (2 risk factors).

• Group 3 were patients with metabolic syndrome (3 or more risk factors).
Metabolic Syndrome Study

• Prevalence of metabolic syndrome in this population was 33% (35% among men and 32% among women). Hypertension was the most prevalent component of the syndrome (81.6%). The most common combination of 3 components of the syndrome were central obesity, hypertriglyceridemia (high blood fat levels) and hypertension (high BP) 43.7%.

• One in every three patients between 40 and 60 years old met the criteria for the syndrome.
Module 2
Metabolic Terms
What You Will Learn

• Metabolic Terms
• Resting Metabolic Rate Explained
• The Afterburn Effect
Metabolic Terms

- Metabolism
- Catabolism
- Anabolism
- Metabolic Rate
- Basal Metabolic Rate (BMR)
- Resting Metabolic Rate (RMR)
- Body Composition
- Lean Body Mass
- Body Fat %
- Body Mass Index
- Waist-to-Hip Ratio
- Caloric Expenditure
- Macronutrient Ratios
Metabolic Terms

• Metabolism: The entire range of biochemical processes that happen within a person or living organism. Metabolism is a term used to refer particularly to the breakdown of food and its subsequent transformation into energy the person's body needs.

• Metabolism is something that consists of both “Catabolism,” and “Anabolism,” which are the build-up and breakdown of substances.

• Catabolism: The body processes food (breaks it down) to use for energy. An example of this process is the digestion
Metabolic Terms

- **Anabolism**: The process in which the person's body uses food in order to either repair or build cells. An example of this is the assembly of amino acids into larger proteins and the subsequent synthesis of fat and glycogen for the person to use as energy.

- **Metabolic Rate**: Refers to the amount of chemical energy a person frees from their body per unit time. Chemical energy is something that is measured in calories or the amount of energy that will heat one gram of water by one degree Celsius.
Metabolic Terms

• Basal Metabolic Rate (BMR): It is the minimum calorie requirement they need in order to sustain life while resting in a 24-hour period. A person's BMR may be responsible for burning up to seventy per cent of their total calories they expend, although this figure varies according to various factors. BMR is taken after 8 hours of sleep, fasting for 12 hours without movement.

• Resting Metabolic Rate (RMR) or Resting Energy Expenditure (REE): Similar to BMR but takes into consideration the following factors: age, body fat %, body
Metabolic Terms

- **Body Composition**: Refers to the percentages of fat, bone and muscle in the human body. These different components make up a person’s total weight.

- **Lean Body Mass**: Everything in your body besides fat. It includes organs, blood, tissue, bones, skin and water. LBM = body weight – (body weight x body fat %)

- **Body Fat %**: The amount of fat in pounds or expressed as a percentage of total weight. It includes essential fat and storage fat. There are recommended levels of body fat depending on age and fitness level.

- **Body Mass Index**: A weight to height ratio, calculated by dividing one’s weight in kilograms by the square of one’s height in meters, and used as an indicator of obesity and underweight.
Metabolic Terms

– Waist-to-Hip Ratio: The circumference of the waist to that of the hips, to determine overall health risk. Divide the waist measurement into the hip measurement to get the ratio.

– Caloric Expenditure: The amount of energy (measured in calories) the body uses at any given time. Caloric expenditure changes based on the level of activity.

– Macronutrient Ratio: The total percentage of calories that break down into carbs, fat and protein. Macronutrient ratios depend on the person’s goals and daily calorie needs.
Resting Metabolic Rate (RMR) Defined

- Resting metabolic rates decline with weight loss
- Example: 200lb woman who should weigh 140lbs would start with a RMR (or BMR) of approximately 1800 calories. When they get to their goal weight, their RMR may only be 1200–1400 calories
- When you weigh less, it takes less energy to carry yourself around – requiring less calories
- Does not necessarily mean they slowed their metabolism
Resting Metabolic Rate (RMR) Defined

– Participants who lost weight but not body fat (didn’t follow the program!) will also have a lower RMR

– A lower RMR, in this case, is not appropriate since the weight lost mostly came from water and FFM

– This weight will be regained quickly

– Athletes and lean people who are muscular will have a higher RMR

– This is because it takes more calories to maintain their lean muscle mass, since muscle is metabolically active

– When clients resistance train 4–5 times per week, they get to eat more to ensure they grow muscle and maintain their lean mass
The Afterburn Effect

– Otherwise known as “excess post-exercise oxygen consumption” or EPOC

– Several studies suggest a strong correlation between the number of post-exercise calories burned and the activity’s intensity

– The longer and more intense the exercise, the more oxygen the body consumes afterward. This means a higher sustained metabolic rate and thus more calories burned throughout the day
The Afterburn Effect

– In one study, participants who cycled vigorously for 45 minutes burned roughly 190 calories more in the 14 hours after exercise, than on days when they didn't work out at all

– For most people, optimal post-exercise calorie burn will occur with exercise performed at 70 to 85 per cent of the individual's max heart rate

– High-intensity interval training has been shown to elicit an even greater post-workout burn, as well as resistance training, performed at quick paces and/or high intensity
Module 2: What Is Body Composition & How to Measure It
What You Will Learn

• What Body Composition Is
• How to Measure Body Composition & Weight-Related Disease Risk Factors
What is the single most important factor as you age?
10 Biomarkers of Aging

• Muscle Mass
• Strength
• Basal Metabolic Rate
• Fat Percentage
• Aerobic Capacity
• Blood Sugar Tolerance
• Cholesterol HDL Ratio
• Blood Pressure
• Bone Density
• Temperature Regulation
What Is Body Composition?

• Body composition is used to describe the percentages of fat, bone and muscle in the human body

• These different components make up a person’s total weight

• Measuring weight alone does not determine the lean-to-fat ratio of the person’s weight

• Two people who weigh the same and are the same height, might look completely different because they have different body compositions
What Is Body Composition?

• Body fat percentage is the total weight of the person's fat, divided by the person’s weight, and consists of essential body fat and storage body fat.

• Essential body fat is necessary to maintain life and reproductive functions. Essential fat is 3%–5% in men, and 8%–12% in women.

• Storage body fat consists of fat accumulation in adipose tissue, part of which protects internal organs in the chest and abdomen.
Weight Loss vs. Fat Loss

“Weight and BMI do not evaluate body compartments and therefore do not reveal if weight changes result in loss of fat-free mass or gain in fat mass.”

J Amer Diet Assoc 2002; 102(7):944-955
Weight Loss vs. Fat Loss

• Losing pounds on the scale does not always mean fat loss
• Weight loss does not always lead to improved health
• Monitor weight loss – is the loss fat, lean muscle or water
• A regular weight scale is inadequate because it cannot determine if you are losing or gaining in a healthful way
Weight Loss vs. Fat Loss

• Muscle is the body’s only metabolically active tissue
• Fat is burned inside of muscle
• Between the ages of 30–80, the average person loses up to 50% of his/her lean muscle
• Unless measuring body composition, this will show up on the scale as weight loss
Body Composition Terms

• **FFM (LBM):** Fat Free Mass = muscle, bone, water (metabolically active)

• **FM:** Fat Mass = pure fat (not metabolically active)

• **TBW:** Total Body Water = level of hydration (measured in lbs or percentage)
Measuring Body Composition

• Bioelectrical Impedance (BIA):
• Variety of scales or devices that can measure total weight, body fat percentage, FFM, FM TBW, bone density
• Foot scales or hand-held body fat analyzers
• Price ranges for these devices vary – make sure the device has what you need
Measuring Body Composition

• Measures body fat percentage using a safe, low-level, electrical current through the body, and an algorithm that requires the person’s age and height
• The current travels at different speeds, depending on the type of tissue it is travelling through
• The current passes quickly through FFM but slowly through FM
• The resistance that is encountered, as the current moves through FM, is the bioelectrical impedance
Measuring Body Composition

• Readings can be affected by the person’s hydration levels, food intake and skin temperature

• If the person is dehydrated, their body fat percentage will read higher because water is a large component of FFM

• Conversely, if the person is well hydrated, it would bring their body fat percentage down, while potentially increasing their weight

• This is important to understand because the person’s weight in pounds may not change but their body fat percentage will change
Body Mass Index

- Medically accepted method of determining obesity and health risks
- Does not take into consideration the person’s body composition, fat distribution or bone structure
- Normal BMI does not always mean the person is healthy (skinny fat person)
- BMI Formula = kg / m² (squared)
Waist-to-Hip Ratio

• Medically accepted method of assessing risk for cardiac and metabolic diseases

• It’s used to determine where the adipose fat is being held

• People with normal BMI’s can have increases in abdominal visceral fat, putting them at greater risk
Body Shape

“Apple” vs. “Pear”

Above the waist
Below the waist
Measuring WHR

• Use a measuring tape
• Close legs and measure the hip circumference at the widest part of your buttocks
• Measure the waist circumference at the smallest part of the waist, just above the belly button
• Divide the waist measurement by the hip measurement