

CHAPTER ONE

CONCEPTS OF PHYSICAL FITNESS

1.1. Meanings and Definitions of Terms

1.1.1 Physical fitness

Physical fitness is essential for human beings to adjust well with his environment as his mind and body are in complete harmony. It is an ability to meet the ordinary, as well as unusual demands of daily life safely and effectively without being overly fatigued. Simply it is the body's ability to function effectively and efficiently, and contributes the total quality of life. Physical fitness is not a static factor and it varies from individual to individual and in the same person from time to time depending on factors. Physical fitness is probably the most popular and frequently used term in physical education.

1.1.2 Physical Activity

It is bodily movement produced by skeletal muscles that results in energy expenditure. The term, physical activity, does not require or imply any specific aspect or quality of movement. The term encompasses all types, intensities, and domains.

1.1.3 Physical Exercise

Exercise is physical activity that is **planned, structured, repetitive, and purposive** in the sense that improvement or maintenance of one or more components of physical fitness is an objective. The term "exercise" has been used interchangeably with "physical activity", and, in fact, both have a number of common elements. For example, both physical activity and exercise involve any bodily movement produced by skeletal muscles that expends energy, are measured by kilocalories ranging continuously from low to high, and are positively correlated with physical fitness as the intensity, duration, and frequency of movements increase.

1.1.4 Sport

It is an organized, competitive form of play. Some persons view sport simply as an organized form of play, which might put it closer to physical education. However, close consideration will show that sport has traditionally involved competitive activities.

When we refer to sport as “organized” competitive activity, we mean that the activity has been refined and formalized to some degree- that is, some definite form or process involved. Rules, whether they are written or not, are involved in this form of activity, and these rules or procedures cannot be changed during the competition, though new ones may involve from one episode to the next. Sport is, above all, competitive activity. We cannot think of sport without thinking of competition, for without the competition, sport becomes simply play or recreation.

1.2. Factors Affecting Physical Fitness

1. Age

- ✓ **Strength:** Maximum Strength easy to build muscle around 20's and 30's
After 30's protein and muscle mass fall and strength declines
- ✓ **Injury and disease:** Older = more injury, longer recovery, more disease
- ✓ **Flexibility:** Most flexible in teens 30+ less flexible; Oxygen Capacity Falls and less taken by muscles
- ✓ **Reaction Time:** Slower
- ✓ **Experience:** Vital factor, more as you age

2. Gender

- **Men**
 - Up to 50% stronger – testosterone promotes the growth of muscle and bone (Strength)
 - Larger hearts and lungs and more blood (CV Endurance)
 - Red blood cells contain more haemoglobin (carry O₂) (CV Endurance)
 - Larger, heavier and bigger bones (Bone structure)
 - Move Faster- more power between trunk and legs (power)
- **Women**
 - Wider pelvis – less effective transmission of power between trunk and leg
 - More flexible than men
 - More body fat- extra strain on the heart, joints and muscles
 - Menstruation and pregna

3. Physique: Certain physiques suit certain sports

- **Endomorph** (dumpy) – Sumo Wrestler; **Ectomorph** (thin) – marathon runner; **Mesomorph** (Muscular)- Swimmer

4. **Diet:** Body needs certain substances for energy and growth and repair
5. **Exercise:** However unfit you are regular exercise will make you fitter
6. **Physical Disability:** Disability means that a part of your body does not function properly and exercise can keep the rest of the body very fit. Many disabled people are elite athletes
7. **Illness and Fatigue:** When you are tired or ill you are less fit for activity
8. **Drug Taking:** Alcohol, cigarettes and many other substances lower fitness
9. **Stress:** Short term stress affects performance = tight muscles, lack of concentration, make mistakes
10. **The Environment:** Pollution – affects lungs and fitness; Weather – hot humid day / windy day, Altitude

1.3 General Principles of Fitness Training

1.3.1 Principle of Overload

The principle of overload suggests that in order to see an improvement in fitness (i.e., response), the dose of physical activity must exceed that to which the individual is already accustomed. The dose of physical activity is controlled by the manipulation of frequency, intensity, time, and type of exercise, otherwise known as the FITT principle. However, for overall/absolute training progress, the individual's muscles or muscle groups must be subjected to greater and greater overloads over time.

1.3.2 FITT Principle

In exercise, the amount of stress placed on the body can be controlled by four variables: Frequency, Intensity, Time (duration), and Type of exercise, better known as FITT.

A. Frequency and Time

Frequency relates to how often exercises are performed over a period of time. In most cases, the number of walking or jogging sessions would be determined over the course of a week. A beginner may determine that 2–3 exercise sessions a week are sufficient enough to stimulate improvements. On the other hand, a seasoned veteran may find that 2–3 days is not enough to adequately stress the system.

The duration of exercise, or time, also contributes to the amount of stress experienced during a workout. Certainly, a 30-minute brisk walk is less stressful on the body than a 4-hour marathon.

B. Type of Exercise

Simply put, the type of exercise performed should reflect a person's goals. In cardiorespiratory fitness, the objective of the exercise is to stimulate the cardiorespiratory system. Other activities that accomplish the same objective include swimming, biking, dancing, cross country skiing, aerobic classes, and much more. As such, these activities can be used to build lung capacity and improve cellular and heart function. However, the more **specific** the exercise, the better the result will be.

C. Intensity

Intensity, the degree of difficulty at which the exercise is carried out, is the most important variable of FITT. More than any of the other components, intensity drives adaptation. Because of its importance, it is imperative for those beginning a fitness program to quantify intensity, as opposed to estimating it as hard, easy, or somewhere in between.

1.3.3 Principle of Rest, Recovery, and Periodization

The principle of rest and recovery (or principle of recuperation) suggests that rest and recovery from the stress of exercise must take place in proportionate amounts to avoid too much stress. The principle of periodization suggests that training plans incorporate phases of stress followed by phases of rest. Training phases can be organized on a daily, weekly, monthly, and even multi-annual cycles, called micro-, meso-, and macrocycles, respectively.

1.3.4 Principle of Reversibility

The principle of reversibility suggests that any improvement in physical fitness due to physical activity is entirely reversible. In other words, “use it or lose it.” This principle suggests that regularity and consistency of physical activity are important determinants of both maintaining and improving fitness.

1.3.5 Principle of Individual Difference:

The principle of individual variability suggests that the individual response (i.e., adaptation) to physical activity is highly heterogeneous. In other words, no two individuals will respond in exactly the same way to a similar dose of physical activity.

CHAPTER TWO

2. HEALTH BENEFITS OF PHYSICAL EXERCIS

2.1. Physical Activity and Hypokinetic Diseases/ Conditions

Hypokinetic diseases are conditions related to inactivity or low levels of habitual activity. Physical activity lowers the risk of hypokinetic conditions including dying prematurely, coronary artery disease, stroke, type 2 diabetes, metabolic syndrome, high blood lipid profile, cancers (colon, breast, lung, and endometrial), and hip fractures. It also reduces abdominal obesity and feeling of depression and anxiety. Physical activity helps in weight loss, weight maintenance and prevention of weight gain, prevention of falls, and improved functional health, improved cognitive function, increased bone density, and improved quality of sleep.

2.2. Physical Activity and Cardiovascular Diseases

2.2.1 Physical Activity and Coronary Heart:

Disease Approximately 6% of CHD deaths worldwide can be attributed to a lack of physical activity (WHO, 2010). Physically active people have lower incidences of myocardial infarction and mortality from CHD and tend to develop CHD at a later age compared to their sedentary counterparts. Leading a physically active lifestyle may prevent 20% to 35% of cardiovascular diseases. Physical activity exerts its effect independently of smoking, hypertension, hypercholesterolemia, obesity, diabetes, and family history of CHD. Individuals who do not exercise regularly are at a greater risk for developing chronic diseases such as coronary heart disease (CHD), hypertension, hypercholesterolemia, cancer, obesity, and musculoskeletal disorders. Regular physical activity increases the pumping of the blood and oxygen. Thus, results in a slower heart rate and greater heart efficiency.

2.2.2. Hypertension

Hypertension, or high blood pressure, is a chronic, persistent elevation of blood pressure that is clinically defined as a systolic pressure ≥ 140 mmHg or a diastolic pressure ≥ 90 mmHg. Regular physical activity prevents hypertension and lowers blood pressure in younger and older adults who are normotensive, prehypertensive, or hypertensive. Compared to normotensive individuals, training-induced changes in resting systolic and diastolic blood pressures (5–7 mmHg) are greater for hypertensive individuals who participate in endurance exercise.

2.2.3 Hyper-Cholesterolemia and Dyslipidemia

Hypercholesterolemia, is an elevation of total cholesterol (TC) in the blood, is associated with increased risk for CVD. Hypercholesterolemia is also referred to as hyperlipidemia, which is an increase in blood lipid levels; dyslipidemia refers to an abnormal blood lipid profile. Regular physical activity, especially habitual aerobic exercise, positively affects lipid metabolism and lipid profiles. Cross-sectional comparisons of lipid profiles in physically active and sedentary women and men suggest that physical fitness is inversely related to TC and the TC/HDL-C ratio (Shoenhair and Wells 1995).

2.2.4 Diabetes Mellitus

Diabetes is a global epidemic. More than 346 million people worldwide have the disease (WHO, 2011). Factors linked to this epidemic include urbanization, aging, physical inactivity, unhealthy diet, and obesity. At least 65% of people with diabetes mellitus die from some form of heart or blood vessel disease (AHA, 2008). Diabetes is a major contributor toward the development of CHD and stroke. Also, diabetes is among the leading causes of kidney failure; 10% to 20% of people with diabetes die of kidney failure (WHO, 2008). The effect of exercise alone as an intervention for people with type I diabetes is not well researched. However, exercise (30–120 min, 3 days/wk for 8 wk) produced clinically significant improvements in HbA1c and reduced visceral and subcutaneous adipose tissue stores in people with type II diabetes.

2.2.5. Aging

A sedentary lifestyle and lack of physical activity reduce life expectancy by predisposing the individual to aging-related diseases and by influencing the aging process itself. With aging, a progressive loss of physiological and metabolic functions occurs; however, biological aging may differ considerably among individuals due to variability in genetic and environmental factors that affect oxidative stress and inflammation. Telomeres are repeated DNA sequences that determine the structure and function of chromosomes. With aging and diseases associated with increased oxidative stress (e.g., CHD, diabetes mellitus, osteoporosis, and heart failure), telomere length decreases. Thus, regular exercise benefits in retarding the aging process and diminishing the risk of aging-related diseases.

2.2.6. Obesity and Overweight

Individuals with a BMI between 25 and 29.9 kg/m² are classified as overweight; those with a BMI of 30 kg/m² or more are classified as obese. While WHO (2012) acknowledges the utility of BMI as a simple index of obesity, they also caution that it cannot account for the relative fatness of different individuals having the same BMI. Actually, they define overweight and obesity as having *abnormal or excessive fat accumulation that may impair health*. Regardless, overweight and obesity ranks as the fifth leading risk factor for death worldwide (WHO, 2012).

Excess body weight and fatness pose a threat to both the quality and duration of one's life. Obese individuals have a shorter life expectancy and greater risks of CHD, stroke, dyslipidemia, hypertension, diabetes mellitus, certain cancers, osteoarthritis, sleep apnea, abnormal menses, and infertility (National Heart, Lung, and Blood Institute, 2012). Restricting caloric intake and increasing caloric expenditure through physical activity and exercise are effective ways of reducing body weight and fatness while normalizing blood pressure and blood lipid profiles.

2.3. Physical activity and postural deformity

Posture is the position from which movement begins and ends. Having proper postural alignment enables the body to perform movements quicker with less joint and muscular strain. To improve your posture and reduce structural damage, you should adhere to a corrective postural exercise program. This simple yet productive program will combat the effects of bad posture and help alleviate joint and muscle pain.

2.3.1 Musculoskeletal Diseases and Disorders

Diseases and disorders of the musculoskeletal system, such as osteoporosis, osteoarthritis, bone fractures, connective tissue tears, and low back syndrome, are also related to physical inactivity and a sedentary lifestyle. Osteoporosis is a disease characterized by the loss of bone mineral content and bone mineral density due to factors such as aging, amenorrhea, malnutrition, menopause, and physical inactivity.

2.3.2 Low Back Pain

Low back pain afflicts millions of people each year. More than 80% of all low back problems are produced by muscular weakness or imbalance caused by a lack of physical activity if the muscles are not strong enough to support the vertebral column in proper alignment, poor posture results and low back pain develops. Excessive weight, poor flexibility, and improper lifting habits also contribute to low back problems.

CHAPTER THREE

3. MAKING WELL-INFORMED FOOD CHOICES

Proper nutrition is a vital consideration for individuals who seek to maximize their performance. Just as using the proper gasoline, oil, or radiator fluid, is important for your vehicle, eating the proper food will directly affect how the body “machine” operates. A proper diet will provide the necessary raw material to allow a good training program to build and run the human machine. The science which studies about action of food, beverages, and their components in biological systems is called nutrition.

3.1. Sound Eating Practices

Sound eating practices can help minimize the damage caused by exercise and help your body rebuild itself even stronger. Your daily diet needs to meet the tough demands of your training programme as well as keep you healthy.

Why is Nutrition Important?

Good nutrition is essential to:

- Preserve and build muscle
- Maintain healthy bones
- Maximize oxygen transport and use
- Repair existing cells and create new tissue
- Maintain optimal fluid and electrolyte balance
- Provide energy

A. Macronutrients

1. **Carbohydrates:** Contain C,H ,O : calories obtained from CHO is 4 kcal/g

Role in the Body

- Fuel during high intensity exercise
- Spares protein (to preserve muscle mass during exercise)
- Fuel for the Central Nervous System (your brain!)

Recommended Allowance

- Sedentary Individuals: 40-50% of your total daily calories should be carbohydrates
- Exercises Regularly: 60% of your total daily calories should be carbohydrates

- Athletes or persons involved in heavy training: 70% of your total daily calories should be carbohydrates (3.5-4.5 grams of carbohydrate per pound of body weight)

Sources: pasta, rice, cereals, breads, potatoes, milk, fruit, sugar

2. Proteins: Contain C,H ,O and N; calories obtained from portion is 4 kcal/g

Role in the Body

- Form the building blocks for new tissues and the repair of body cells.
- For making enzymes, hormones and antibodies.
- Protein also provides a (small) fuel source for exercising muscles.

Sources: meat, dairy, legumes, nuts, seafood and eggs

The IOC and IAAF both recommend between 1.2 and 1.7 g protein/kg BW/day for athletes or 84–119 g daily for a 70 kg person. This is considerably more than a sedentary person, who requires 0.75 g protein/kg BW daily.

3. Lipids (most commonly called fats): Contain C,H ,O:

- calories obtained from lipids is 9 kcal/g
- Consist of fatty acids, triglycerides, phospholipids, and sterols (cholesterol).
- 20–33% of the calories in your diet should come from fat

Role in the Body

- Energy reserve
- Protects vital organs
- Insulation
- Transport fat soluble vitamins

Recommended Daily Allowance

- 20-35% of your total daily calories should come from fat
- Less than 10% of total daily calories should come from Saturated Fat (coconut and palm kernel oil, shortening, butter, cream cheese, full fat dairy products)

Sources: oils, butter, margarine, nuts, seeds, avocados and olives, meat and seafood

4. Water: Contain H and O

- It is the only macronutrient that provides no energy

Role in the Body

- Regulates body temperature.
- Moistens tissues in the eyes, nose and mouth.
- Protects body organs and tissues.
- Carries nutrients and oxygen to cells.
- Lubricates joints.
- Lessens burden the on kidneys and liver by flushing out waste products.

Recommended Daily Allowance

- About 15.5 cups (3.7 liters) of fluids a day for men
- About 11.5 cups (2.7 liters) of fluids a day for women
- These recommendations cover fluids from water, other beverages and food. About 20% of daily fluid intake usually comes from food and the rest from drinks.

Sources: found as a beverage and a component of many foods, especially vegetables and fruits.

B. Micronutrients

- 1. Vitamins:** Common vitamins include the water soluble B group vitamins and vitamin C and the fat soluble vitamins A, D, E and K

Role in the Body

- Take part in mineral and bone metabolism, cell and tissue growth, formation of hemoglobin and, and they act as cofactors for energy metabolism

Recommended Daily Allowance

Sources:

- Fruits and vegetables are generally good sources of Vitamin C and A and folic acid (a B group vitamin)
- Grains and cereals are generally good sources of the B group vitamins and fiber
- Full-fat dairy and egg yolks are generally sources of the fat soluble vitamins A, D and E
- Milk and vegetable or soya bean oil are generally good sources of vitamin K, which can also be synthesized by gut bacteria

2. Minerals:

- Are sodium, calcium, iron, iodine, magnesium, etc.
- All foods contain some form of minerals.
- **Role in the Body**
 - Shore up bones; heal wounds, and bolster your immune system.
 - They also convert food into energy, and repair cellular damage.
- **Sources:**
 - Milk and dairy products are a good source of calcium and magnesium
 - Red meat is a good source of iron and zinc
 - Seafood and vegetables (depending on the soil in which they are produced) are generally good sources of iodine

3.2. Nutrition and Physical Performance

There is universal scientific consensus that diet affects performance. A well-planned eating strategy will help support any training programme, whether you are training for fitness or for competition; promote efficient recovery between workouts; reduce the risk of illness or overtraining, and help you to achieve your best performance

1. Nutrition Before Training Exercise

Why eat before training?

The main purpose of your pre-workout meal is to stabilise your blood sugar levels during exercise. It also staves off hunger and minimises the risk of problems such as stitch and hypoglycaemia (low blood sugar levels).

Recommendations

- Fluids: 5-7 ml/kg 4 hrs. prior
- Meal before:
 - +500 ml fluids
 - Large meal; 2-4 g CHO/kg, 2-4 hrs prior
 - Small meal; 1-2 g CHO/kg, 1-2 hrs prior
 - Snack/liquid; < 1 hr

■ Timing varies with:

- Intensity of exercise
- Personal tolerance to food (Be individualized)

2. Nutrition During Exercise

The ideal nutritional strategy during exercise should:

- provide sufficient carbohydrate to maintain blood glucose levels and carbohydrate oxidation
- provide water and electrolytes to prevent fluid imbalance
- not cause any gastro-intestinal discomfort taste good.

Goals (why?)

- Prevent hypoglycemia
- Maintain hydration
- Prevent hyponatremia

Recommendations

The following are general recommendations of nutrition during exercise:

1. During intense exercise lasting >45 min a carbohydrate drink should be ingested.
2. Consume 60 g of carbohydrate per hour of exercise.
3. During exercise of < 45 min duration there appears to be little need to consume carbohydrate.
4. Insoluble carbohydrate sources are relatively slowly absorbed and oxidized, and are therefore not recommended for high intensity exercises.
5. Athletes should consume beverages containing carbohydrate throughout exercise, rather than water during the early part of an exercise.
6. Avoid drinks which have extremely high carbohydrate contents (>20%) and those with a high osmolality (>500 mosmol/kg)
7. Try to predict the fluid loss during endurance events of >90 min.
8. Large volumes of a drink stimulate gastric emptying more than small volumes.
9. Athletes should practice drinking while exercising as training can increase the volume that the gastrointestinal tract will tolerate.
10. Fibre and protein content, and high carbohydrate concentration and osmolality should be avoided.

3. Nutrition After Exercise

Goals (why?)

RECOVERY : The quicker you can begin refueling after exercise, the quicker your body will recover.

- ✓ Because of its delay for recovery, fluids like carbonated drinks and alcohol are wrong choices for recovery
- ✓ Some Energy drinks may lead for anxiety, insomnia, GI upset, rapid heartbeat, higher risk for injury, unwanted withdrawal symptoms.

Recommended fluids...

- | | |
|-----------------------|---------------|
| ➤ Water | ➤ Sport drink |
| ➤ 100% fruit juice | ➤ Yogurt |
| ➤ Milk/Chocolate milk | ➤ Smoothies |

Post-game meal

- High CHO, Moderate Pro & Fat with Ample Fluids & Salt RECOVERY
- Take in food/cal. within 2 hours
- 3:1 ratio of CHO to Protein

CHAPTER FOUR

HEALTH RELATED COMPONENTS OF FITNESS

In order to carry out daily activities without being physically overwhelmed, a minimal level of fitness is required. To perform daily activities without fatigue, it is necessary to maintain health in five areas: cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition. These five areas are called the **components of health related fitness**.

4.1. Cardiovascular fitness

4.1.1. Meaning and concepts of cardiovascular fitness

Cardiorespiratory fitness: (sometimes called aerobic fitness or cardiorespiratory endurance) is considered to be a key component of health-related physical fitness because it is an indication of a person's overall physical health. It is a measure of a heart's ability to pump oxygen-rich blood to the working muscles during exercise. It is also a measure of the muscle's ability to take up and use the delivered oxygen to produce the energy needed to continue exercising. In practical terms, cardiorespiratory endurance is the ability to perform endurance-type exercise such as (distance running, cycling, swimming, etc.).

4.1.2. Means and methods of developing cardiovascular Fitness

A. How to develop?

- There are several training methods to develop cardiorespiratory fitness. However, all methods of training need to be specific to the individual performer, component of fitness and the activity.
- i. **Continuous training:** is a form of exercise that is performed for minimum of 30 minutes at a 'continuous' intensity (Steady pace) throughout and doesn't involve any rest periods. It can be performed at a low, moderate or moderate/high intensity depending on what you want to achieve from the training and your current fitness levels. It's more recommended to perform moderate intensity (sub-maximal work) or Target heart rate range between 60% - 80% maximum heart rate (maxHR). Continuous training typically involves aerobic activities such as running, biking, swimming and rowing, walking etc.

- ii. **Interval training:** involves periods of high intensity ($\sim > 60\%$ VO_2 Max) exercise or work followed by periods of recovery that can be in the form of total rest, walking or active recovery. It is effective at improving cardiovascular fitness when we increasing intensity with less rest period. Typically, interval training involves a work-rest ratio of 1-2, for example, exercising for 30 seconds, resting for one minute. The length of work periods and rest is dependent on your intended outcome.
- iii. **Fartlek (speed play) training:** Fartlek is a Swedish word for speed play and is a form of continuous training during which the speed or terrain of the activity is varied so that both aerobic and anaerobic energy systems are stressed. Intensity can also be altered using equipment (E.g.) Harness, Running with weights. This could involve periods of sprinting, jogging or walking or could include uphill, downhill and flat running.
- iv. **Any aerobic activities**

B. Exercise prescription for CVE

Dosage		Remark
Mode	Any aerobic activity that uses a large muscle mass (e.g., the legs) in a slow, rhythmical pattern keeping the heart rate	E.g. brisk walking, jogging, running, cycling, swimming, aerobics, rowing, stair climbing, hiking, cross country skiing and many types of dancing
Frequency	3-5 days/week	If training is injury-free, the frequency can be increased to 5 days/week
Intensity	50% - 85% VO_2 max.	
Duration	20 and 60 minutes	<ul style="list-style-type: none"> Does not include the warm-up or cool-down. Depend on fitness E.g. 20 to 30 minutes for beginners 40-60 min for highly trained person

4.2. Muscle fitness

4.2.1. Meaning and concepts of muscle fitness

There are two components of muscle fitness: strength and muscular endurance.

1. **Muscular Endurance-** is defined as the ability of a muscle to generate force over and over again (REPEATEDLY over a period of time).
2. **Muscular strength:** is the maximal ability of a muscle to generate force. It is evaluated by how much force a muscle can generate during a single maximal contraction. Practically, this means how much weight that an individual can lift during one maximal effort.

4.2.2. Means and methods of developing muscle fitness

A. How to develop?

- There are many ways to improve muscular strength and endurance
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- **Static (Isometric) exercises:** also known as static strength training, are contractions of a particular muscle against resistance for an extended period of time. Simply put, an isometric exercise is one that involves muscle engagement without movement or muscle contracts but does not change in length and the affected joint doesn't move. Instead, you pick one position and hold it. They can be useful in build strength rapidly and rehabilitation. Doing them for 5-10rep. /day or maximum force for 6-10sec.
 - **Isokinetic exercises:** are forms of dynamic resistance-based exercises that involve the use of special exercise equipment, which provides variable resistance to a movement and allows muscles to contract (changing its length) at constant speeds. This ensures that no matter how much effort is exerted, the exercise movements take place at a constant speed. Because the amount of resistance can be controlled, it is possible to set the level (about 10-15 repetitions) so that the body is challenged but not in danger of straining or pulling the muscles.
 - **Dynamic (Isotonic) Exercise:** Isotonic comes from the Greek “iso-“, equal + “tonos”, tone = maintaining equal (muscle) tone. Dynamic exercise is an exercise in which the tension applied to muscle remains unchanged while the length of opposing muscles changes such as when a contracting muscle shortens against a constant load, for example when lifting weights for the conditioning of a muscle group. They can be **concentric contractions** (when your muscle shortens as you overcome the force of a weight) or **Eccentric**

contractions (when your muscle lengthens while being opposed by the force of a weight). They can also performed without or with equipment (E.g.) calisthenics, resistance machine exercises, and pulley weights, squats, push-ups...

- **Circuit Resistance Exercises (CRT):** This involves a series of exercises, known as stations, being performed one after the other. Typically circuit training involves 8-10 stations, consists of combinations of weight training, flexibility, calisthenics and brief aerobic exercises, performed for a certain number of repetitions (not less than three times) or time. When planning a circuit it is important to vary the muscle group you work and think about the number of repetitions or time spent on each station.
- **Plyometric exercises:** is a quick, powerful dynamic (isotonic) movement involving a system of reactive exercises and an eccentric contraction, followed immediately by an explosive concentric contraction. They include activities that enable a muscle to reach maximal force in the shortest possible time. (E.g.) hops, bounds, hopping on one foot.

B. Exercise prescription for Muscle fitness

Muscular Endurance		
Dosage		Remark
Mode	Resistance training, yoga, Pilates, light weights.	An activity that allows the muscles to perform a physical task over a period of time without becoming fatigued E.g. Plank, Body weight squats, Walking lunges, Pushups, Sit-ups.
Frequency	Weight train 2-4 times per week.	
Intensity	When lifting weights, train to fatigue and in general, perform 15-20 repetitions during the workout.	add or maintain weight and repetitions
Duration	30-60 minutes.	

Muscular Strength		
Mode	Anaerobic activities such as weight lifting and sit ups	E.G. Lifting weights, working with resistance bands, heavy gardening, such as digging and shoveling, climbing stairs, hill walking, cycling, dance, push-ups, sit-ups and squats.
Frequency	2-4 times per week	
Intensity	60-75% of max 3 sets of 8-12 repetitions	
Duration	30-60 minutes.	

4.3. Flexibility

4.3.1. Meaning and types of flexibility

Flexibility- is the ability to move joints freely through their full range of motion. Flexible individuals can bend and twist at their joints with ease. Without routine stretching muscles and tendons shorten and become tight, this can retard the range of motion around joints and impairer flexibility

4.3.2. Means and methods of developing flexibility

A. How to develop?

- a. **Ballistic stretching (“bouncing” stretching):** is stretching by bouncing into (or out of) a stretched position and using momentum to do a hyperextended stretch, these extend the muscles as well as tendons through a greater range of movement. Because of increased risk for injury, ballistic stretching is recommended to increases flexibility, when properly performed.
- b. **Static Stretching:** the traditional and most popular technique is static stretching, where a specific position is held with the muscle on tension to a point of a stretching sensation and repeated. This can be performed passively by a partner, or actively by the subject.

Static stretching involves slowly **passive** stretching a muscle/tendon group and holding the position for a period (i.e., 10-30 s). Static stretching can be active or passive. It is a safer technique for sedentary or untrained (beginner), and hence recommended to repeated 3 to 4 times, for 15 to 30 seconds for each repetition.

- c. Proprioceptive Neuromuscular Facilitation (PNF):** is a more advanced form of flexibility training, which involves both the stretching and contracting of the muscle group being targeted to its limit. Doing this triggers the inverse myotatic reflex, a protective reflex that calms the muscle to prevent injury. It is also the most effective forms of stretching for improving flexibility and increasing range of motion. It is best to do for 3-5 rep (10 second pushing phase followed by a 10 second relaxing phase with 20sec rest b/n reps.)

B. Exercise prescription for flexibility

Dosage		Remark
Mode	Stretches that allow the body to move through the full range of motion; <ul style="list-style-type: none"> • Dynamic stretch (prepares body for exercise) • Static stretch (done after warmed up) • PNF (Proprioceptive Neuromuscular Facilitation) 	e.g. forward lunges, side lunges, cross-over, standing quad stretch, seat, straddle lotus, seat side straddle, seat stretch, knees to chest
Frequency	2 – 3 days per week	
Intensity	Stretch to the point of mild uncomfortableness, to the point where you feel the tension but not pain	
Duration	15 – 30 minutes per day, hold stretch for 20 – 60 seconds	

4.4 Body composition

4.4.1. Meaning of body composition

Body composition is the relative amounts of fat and lean body tissue (muscle, organs, bone) found in your body. It can be improved by decreasing fat mass or increasing muscle mass.

A. How to develop?

Body composition results largely from physical activity levels in the other components:

- Cardiovascular exercise expends calories.
- Muscle strength and endurance activities expend calories and build muscle (muscle burns calories faster than fat!)
- Flexibility exercises allow the body to better tolerate the other exercises.
- Getting proper nutrition!!!!

B. Exercise prescription for MS

Dosage		Remark
Mode	Aerobic, anaerobic, resistance activities to burn fat and activities to build muscle	e.g.; choice to use multipoint or single-joint exercises can be based on personal preference. <ul style="list-style-type: none">• Strength Workouts (<u>Front lunge</u>, <u>walking lunge</u>, or <u>overhead lunge</u>, <u>Planks</u>, <u>Pushups</u> (traditional, modified, or <u>with a stability ball</u>), <u>Squat with an overhead press</u>)• Cardio Exercise (Burpees, Jump, Rope, Jumping Jacks, Squat Jumps, Kickboxing, Dancing, Running the Stairs, Jogging in Place...
Frequency	5 to 7 times per week	• Five sets of 10 repetitions per resistance exercise
Intensity	Combination of intensities	• Higher intensity workouts burn more calories, but a smaller ratio of fat. mixed-intensity protocol(high, low) is an effective, time-saving training method
Duration	Dependent on intensity	

4.4.2. Health risks associated with over fatness and excessively low body fatness

Obesity is an excessive accumulation of fat weight. The recently completed National Children and Youth Fitness Studies report that young people are more obese than ever before. Obesity is associated with many risk factors of CHD (Coronary Heart Disease), high blood pressure, increased levels of blood fat and cholesterol, stroke and diabetes. Reversal of these risk factors can be achieved by reducing an individual's total body fat. Observing good nutritional principles relating to lowering personal consumption of saturated fats, sweets and excessive calories are important lifestyle changes that an individual must make. Exercise and physical activity can also contribute to achieving optimal body composition. The adult onset of obesity appears to be strongly related to poor physical activity patterns. Obese young people tend to be less active than their non-obese peers.

In contrast, it is important to note, very low levels of body fat can cause the development of such medical conditions as heart damage, gastrointestinal problems, shrinkage of internal organs, immune system abnormalities, disorders of the reproductive system, loss of muscle tissue, and damage to the nervous system, abnormal growth and even death. A small but significant number of children also develop eating disorders that lead to extremely low levels of body fat. It is important for students to adopt healthy behaviors that promote acceptable body composition early in life.