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ADDIS ABABA SCIENCE AND TECHNOLOGY UNIVERSITY

PHYSICAL FITNESS

**SHORT NOTES ON AN INTRODUCTION AND DEVELOPMENT
OF PHYSICAL FITNESS
(SpSc 101)**

Unit one Concept of physical fitness

Physical fitness; - it is an ability to meet the ordinary as well as unusual demands of daily life safely and effectively with out being overly fatigued.

Two areas

1. Health related physical fitness – it is dedicated to improving physical fitness;-like cardiovascular endurance, muscular strength muscular endurance,
2. Skill related physical fitness – it is dedicated to improving physical skill like speed, agility, balance, coordination, power, reaction time

Physical activity; - it is a body movement produced by skeletal muscles that result in energy expenditure

Example-occupational, household, any daily tasks

- ✓ Does not require or imply any specific aspect of quality of movement
- ✓ It is not planed, structure, repetitive, and purposive.

Two types of physical activity

1, aerobic – improves an individual cardio respirator

Example –Walking, jogging, running, ball games etc..

2, anaerobic – performed for shorter time about 2-3 minutes

Example – sprinting and power lifting

Physical exercise;- it is a physical activity that is planned structured, planed and purposive

- ✓ it is goal oriented
- ✓ it is done to improve or maintain one or more components of physical fitness (endurance, strength, flexibility)

Example;- 2-3times week jogging for 30 minutes

Sport

- ✓ it is an organized competitive form of play
- ✓ when we refer to sport as organized competitive activity we mean that the activity has been refined and familiarized to some degree
- ✓ it in evolves in rules or procedure during the completion
- ✓ we cannot think of sport without thinking of completion

General principle of fitness training

- ✓ The human body adapts when exposed to stress (exertion above the normal)
- ✓ Knowing a little about these principle provides valuable insight needed for an organized and effective fitness plan

Principle of overload; - it is the amount of stress applied during exercise ✓

- ✓ Exercise must exceed the threshold level to stimulate adaptation
- ✓ It states that improvement driven by stress
- ✓ involves in gradually increasing the stress

symptoms of overtraining ✓

- ✓ Weight loss, loss of motivation, lack of enjoyment, sleep dispensant feeling of depression,

The FITT Principle; - in exercise the amount of stress placed on the body can be controlled by four variables

- ✓ They are frequency, intensity, time(duration), and type better known as the FITT
- ✓ Those variables fall under the larger principle of overload
- ✓ Frequency - means how often (2-3 times a week)
- ✓ time (duration) - for how long (30-40 minutes)
- ✓ intensity - the degree of difficulty (hard, medium, easy)

Principle of specificity

- ✓ states that specific exercise for selected out comes (i.e. train the way you want to adapt)
- ☒ Example - cardiovascular endurance - walking, jogging,
 - ✓ Strength (muscular) - pushups, power lifting etc..

Principle of reversibility:-

- ✓ adaptation to stress can be lost if modified or stop
- ✓ activity must be continues
- ✓ detraining happens (the partial or complete loss of training induced anatomical, physiological or performance adaptations as a consequence of training reduction or cessation)

principle of individual difference -; the same out come any persone dont have

- ✓ training based on persons age, gender, training status at the start of program

Question

- 1, what do you mean by a person is physically fit?
- 2, define physical activity and give examples?
- 3, define physical exercise and give examples?
- 4, give example for aerobic and anaerobic physical exercise.
- 5, the different between physical activity and physical exercise.
- 6, what are the areas of physical fitness and give examples?
- 7, define sport?
- 8, define the FITT principle?
- 9, define the principle of individual difference?
- 10, prepare your Owen weekly exercise plan

Unit two

The health benefits of physical activity

Physical activity and hypokinetic disease

❖ hypokinetic disease

- it is a condition related to inactivity or low levels of habitual(daily) activity like cleaning, washing, traveling to work etc.

.may result in

✓ Chronic diseases –coronary heart diseases (lack of blood supply to the heart muscles)

✓ Hypertension- high blood pressure ≥ 140 mmhg systolic
 ≥ 90 mmhg diastolic

Prehypertension 120-139 mmhg systolic
80-89 mmhg diastolic

❖ Systolic – the action happens when the heart contracts to, pump the blood

❖ Diastolic – the action happens when the heart relaxes after contraction

❖ Normal blood pressure 120(systolic)/80 (diastolic) mmhg

✓ Cancer

✓ Obesity(overweight)

- Classified using the body mass index (BMI)
- that is $BMI = \text{weight(kg)} / \text{height m}^2$
- BMI between 25 and 29.9 kg/m² classified as overweight
- $BMI \geq 30$ kg/m² is classified as obese
- Aging, gender, family history, much cholesterol intake, physical inactivity, may be the factor for obesity and overweight.
- Restricting much intake of calories and increasing caloric expenditure through regular physical activity and exercise are effective ways to overcome obesity or overweight.

✓ Musculoskeletal disorders

✚ So exercise lowers the risk of hypokinetic like coronary artery diseases, stroke, high blood lipids, hip fractures, weight loss, weight maintenance, improves cognitive function, quality of sleep etc.

✓ Diabetes

- Urbanization, aging, physical inactivity, family history, caloric intake etc.
- Contribute to CHD, stroke, kidney failure

- Type 1 (autoimmune, genetic, or environmental factor) and type 2 (age, family history, caloric intake, physical inactivity, diabetes)
 - Health, nutrition, and physical (exercise) activity may reduce the risk
- ✓ Metabolic syndrome

- Individual with three or more CVD (like hypertension, dyslipidaemias, abdominal obesity)

✓ High blood lipid protein

In general the following are the health benefits of physical activity and exercise.

Lowers risk of

- hypokinetic
 - stroke
 - type 2 diabetes,
 - metabolic syndromes,
 - hip fractures,
- ± Help to maintain weight /to lose weight,
- Improves cognitive function, quality of sleep

Risk factors for CHD

- ± Age, family history,
- ± hypercholesterolemia, hypertension,
- ± tobacco use,
- ± diabetes or pre diabetes,
- ± overweight, obesity, physical inactivity

physical activity and postural deformity

- posture is the position from which movement begins and ends

exercise for correction posture – prone cobra, axial extension, wall leans, cervical extension using a blood pressure cuff etc.

musculoskeletal disease and disorders

- ± osteoporosis, osteoarthritis, bone fracture, connective tissue tears, low back syndrome, are related to physical inactivity and sedentary life.
- ± Osteoporosis :- is a disease characterized by the loss of bone mineral content and bone mineral density due to factors such as aging, malnutrition, menopause, physically inactive.

- Adequate calcium intake, vitamin d intake, regular exercise help to counteract age related bone losses.

UNIT SUMMARY

- Major chronic diseases associated with a lack of physical activity are CVDs, diabetes, obesity, and musculoskeletal disorders.
- Cardiovascular diseases are responsible for 30% of all deaths worldwide.
- The positive risk factors for CHD are the following: age, family history, dyslipidaemia, hypertension, tobacco use, prediabetes or glucose intolerance, obesity, and physical inactivity.
- The prevalence of obesity is on the rise, especially in developed countries; two of every three adults and more than one of every three adolescents and children are overweight or obese.
- BMI is used to identify and classify individuals as overweight or obese. Cut-off values for obesity, however, may vary depending on ethnicity.
- Metabolic syndrome is a term used to describe individuals who have three or more cardiovascular disease risk factors.
- Osteoporosis and low back syndrome are musculoskeletal disorders afflicting millions of people each year.
- To benefit health and prevent disease, every adult should accumulate a minimum of 150 min/wk of moderate-intensity physical activity or 75 min/wk of vigorous-intensity physical activity. For additional health benefits, increase physical activity to 300 min/wk and 150 min/wk, respectively, for moderate- and vigorous-intensity exercise.

Question

- 1, what do you mean by hypokinetic disease ?
- 2, what is a chronic disease ?
- 3, give example of chronic disease .
4. what is the systolic and diastolic blood pressure.
5. calculate your own BMI.
6. what is a metabolic syndrome,
- 7, write the health benefit of exercise .
- 8, write the risk factors for CHD ?
- 9, what is a posture?
- 10, give example of osteoporosis disease and disorders.

UNIT THREE

MAKING WELL-INFORMED FOOD CHOICES

What is Nutrition

- Nutrition can be defined as the science of the action of food, beverages, and their components in biological systems.

what is Nutrient?(Macronutrients, Micronutrients)

- A nutrient is a compound that provides a needed function in the body

Macronutrients

- *Carbohydrates*:- literally means "hydrated carbon," or carbon with water
 - ✓ made up of carbon, hydrogen, and oxygen
 - ✓ important fuel for exercise
 - ✓ Exa ; whole-wheat bread, oatmeal, rice, sugary snacks/drinks, and pasta.
- *Proteins*: comprised of carbon, hydrogen, and oxygen, but they also contain nitrogen.
 - The building blocks for new tissues and the repair of body cells.
 - They are also used for making enzymes, hormones and antibodies.

Exa - nuts, beans/legumes, skim milk, egg whites, and meat.
- *Lipids*: consist of fatty acids, triglycerides, phospholipids, and sterols (cholesterol).
 - are also composed of carbon, hydrogen, and oxygen.

Exa - oils, butter, and egg yolks.

Micronutrients

- *Vitamins*: These compounds are essential for normal physiologic processes in the body.
- *Minerals*: essential for normal physiologic processes in the body.

Calories (Food Energy)

- Food energy is measured in kilocalories (kcal),
- Your daily calorie needs will depend on your genetic make-up, age, weight, body composition, your daily activity and your training programme.

Amount of calories obtained from nutrients

Nutrient	Energy (kcal/g)
Carbohydrate	4
Protein	4
Lipids	9
Water	0
Vitamins	0
Minerals	0

- alcohol.- is not a nutrient
- But it does provide 7 kilocalories of energy per gram.

How to estimate the number of calories you need daily

Step 1- Estimate your Basal Metabolic Rate (BMR)- the number of calories you burn at rest

- As a rule of thumb (a method of judging a situation or condition that is not exact but is based on experience) BMR uses 22 calories for every kg of a woman's body weight and 24 calories per kg of a man's body weight.

Women: $BMR = \text{weight in kg} \times 22$

Men: $BMR = \text{weight in kg} \times 24$

Step 2: Work out your Physical Activity Level (PAL)

This is the ratio of your overall daily energy expenditure to your BMR; a rough measure of your lifestyle activity.



Mostly inactive or sedentary (mainly sitting): 1.2



Fairly active (include walking and exercise 1-2 x week): 1.3



Moderately active (exercise 2-3 x weekly): 1.4



Active (exercise hard more than 3 x weekly): 1.5



Very active (exercise hard daily): 1.7

Calculate your BMR by your PAL to work out your Daily Calorie Needs

$$\text{Daily calorie needs} = \text{BMR} \times \text{PAL}$$

Carbohydrates:

- ✓ Guidelines for daily intakes are about 5–7 g per kg of body weight per day for moderate duration/low intensity daily training. who do moderate–heavy endurance training should consume 7–10 g per kg body weight per day; and those training more than 4 hours per day are advised to consume 10 g or more per kg body weight per day.
- ✓ During exercise lasting longer than 60 minutes, consuming 20–60 g carbohydrate per hour helps maintain your blood glucose level, delay fatigue and increase your endurance.
- ✓ Choose high GI carbohydrates (e.g. sports drinks, energy gels and energy bars, bananas, fruit bars, cereal or breakfast bars), which convert into blood sugar rapidly

Proteins:

- The building blocks for new tissues and the repair of body cells.
- They are also used for making enzymes, hormones and antibodies
- Athletes (1.2-1.7 g/kg) have higher protein requirements than non-active people (0.75).

Fat

- Some fat is essential,
- it makes up part of the structure of all cell membranes, your brain tissue, nerve sheaths, bone marrow and it cushions your organs.
- 'Bad' fats(saturated and trans fats) it must be less than 10 % of calories (the majority is from unsaturated fats)

Fiber – three types

Dietary fiber: contains both non-digestible carbohydrates and lignin and is always intrinsic and intact in plants

- Found mainly in fruits, vegetables, whole grains and legumes — is probably best known for its ability to prevent or relieve constipation. But foods containing fiber can provide other health benefits as well, such as helping to maintain a healthy weight and lowering your risk of diabetes, heart disease and some types of cancer.

Functional fiber contains non-digestible carbohydrates. Functional fibers are isolated, no digestible forms of carbohydrate that have been extracted from starchy foods or manufactured from starches or sugars.

Total Fiber: containing both dietary fiber and functional fiber.

Vitamins

- ✓ Vitamins are organic compounds found in foods and are a necessary part of the biochemical reactions in the body. bone metabolism,
- ✓ Used for cell and tissue growth, bone metabolism, and cell and tissue growth, Vitamins are either fat-soluble or water-soluble. Fat-soluble vitamins A, D, E, and K,

Minerals

- ✓ Minerals cannot be made in the body; they come from the diet.
- ✓ ensure the body functions properly and necessary for the hardening of bones
- ✓ The most common minerals in the body are calcium and phosphorous,

Water

- ✓ You should ensure you are hydrated before starting training competition and aim to minimise dehydration during exercise.

NUTRITION AND PHYSICAL PERFORMANCE

There is universal scientific consensus that diet affects performance. A well-planned eating strategy will help support any training programme

Nutrition before Exercise Training

- ✓ The main purpose of your pre-workout meal is to stabilize your blood sugar levels during exercise.
- ✓ It also staves off hunger and minimizes the risk of problems such as stitch and hypoglycemia (low blood sugar levels).
- ✓ It is definitely not advisable to train on an empty stomach, especially if you want to improve strength, endurance or performance.
- ✓ The exact amount you should eat depends on your body weight (heavier people need more) and how hard and long you plan to exercise (eat more for longer, harder workouts).
- ✓ Don't eat a big meal just before a workout otherwise you will feel uncomfortable, sluggish and 'heavy'
- ✓ For longer workouts or endurance events eat around 2 g carbohydrates per kg of body weight (or 600-800 calories).
- ✓ if you plan to workout for less than 2 hours, aim to eat around 1 g carbohydrate per kg of body weight (or 70 g for a 70 kg person) or 400-600 calories

- ✓ Slow-burning or low glycaemic index (GI) foods – that is foods that produce a gradual rise in blood sugar levels are the best foods before a workout.
- ✓ Low-GI meals may also help you burn more fat during exercise
- ✓ It is important to ensure that you are properly hydrated before training to minimise the risk of dehydration during exercise.
- ✓ The best strategy is to keep hydrated throughout the day rather than load up with fluid just before your workout.
- ✓ It's better to drink little and often rather than drinking large amounts in one go, which promotes urination and a greater loss of fluid.
- ✓ Drink before you get thirsty. By the time your thirst mechanism kicks in you may have lost around 2 per cent of your body weight as water.
- ✓ The American College of Sports Medicine Drink recommends drinking 2–4 glasses of water (400–600 ml) during the 2–3 hours before you workout. Don't drink it all in one go – divide into several smaller amounts and sip at regular intervals.

Nutrition During Exercise

- ✓ Everyone exercising for longer than 30 minutes will certainly benefit from drinking something during exercise.
- ✓ If you plan to exercise longer than 60 minutes, you may also benefit from additional carbohydrate.

The following are general recommendations of nutrition during exercise:

1. During intense exercise lasting >45 min a carbohydrate drink should be ingested. This may improve performance by reducing/delaying fatigue.
2. Consume 60 g of carbohydrate per hour of exercise. This can be optimally combined with fluid in quantities related to needs determined by environmental conditions, individual sweat rates and gastrointestinal tolerance.
3. During exercise of < 45 min duration there appears to be little need to consume carbohydrate.
4. The type of soluble carbohydrate (glucose, sucrose, glucose polymer, etc.) ingested does not appear to make much difference when ingested in low to moderate quantities; fructose and galactose are less effective. However, a combination of fructose and glucose may have physiological benefits. Insoluble carbohydrate sources are relatively slowly absorbed and oxidized, and are therefore not recommended for high intensity events.
5. Athletes should consume beverages containing carbohydrate throughout exercise, rather than water during the early part of an exercise bout followed by carbohydrate beverages at the later stages of the exercise.
6. Avoid drinks which have extremely high carbohydrate contents (>20%) and those with a high osmolality (>500 mosmol/kg) because fluid delivery will be hampered and gastrointestinal problems may occur.

7. Try to predict the fluid loss during endurance events of >90 min. The volume of fluid to be ingested should in principle at least equal the predicted fluid loss. While exercising in warm weather with low humidity, athletes have to drink more to replace sweat loss and the drinks can be diluted. During events in cold weather, athletes require less fluid volume to maintain fluid balance but will still require the carbohydrate to maintain blood glucose levels, therefore the carbohydrate content of the drinks can be more concentrated.
8. Large volumes of a drink stimulate gastric emptying more than small volumes. Therefore, we recommend that athletes ingest a fluid volume of 6-8 ml/kg BW, 3-5 min prior to the start to 'prime' the stomach, followed by smaller amounts (2-3 ml/kg BW) every ~15-20 min.
9. The volume of fluid that athletes can ingest is usually limited. Athletes should practise drinking while exercising as training can increase the volume that the gastrointestinal tract will tolerate.
10. After drinking a large quantity, the stomach may feel empty and uncomfortable. If this occurs it may be wise to eat some easily digested solid food. During long, low intensity competitions solid food can be eaten in the early stages of the event.
11. Fibre and protein content, and high carbohydrate concentration and osmolality have been associated with the development of gastrointestinal symptoms during exercise, and thus should be avoided.

Nutrition after Exercise

- ✓ The quicker you can begin refueling after exercise, the quicker your body will recover.
- ✓ Start drinking before you even get showered and changed.
- ✓ The sooner you begin replacing the fluid you have lost through sweat, the sooner you will recover.
- ✓ Drinking slowly rather than guzzling the lot in one go will hydrate you better, and cut the risk of post-workout dehydration.
- ✓ If you have exercised for less than an hour, plain water is a good choice followed by a carbohydrate-rich snack within 2 hours.
- ✓ Whether you are hungry or not, the quicker you consume food or drink after a workout, the quicker your body will recover.

UNIT FOUR

HEALTH RELATED COMPONENTS OF FITNESS AND PRINCIPLES OF EXERCISE PRESCRIPTION FOR HEALTH AND FITNESS

HEALTH RELATED COMPONENTS OF FITNESS

- ✓ The overall goal of a total health related physical fitness program is to optimize the quality of life.
- ✓ The specific goals of this type of fitness program are
 - to reduce the risk of disease,
 - To improve total physical fitness so that, daily tasks can be completed with less effort and fatigue.
 - Also some conditioning programs aimed at improving sport performance, may reduce the risk disease.

Cardio respiratory Fitness

- ✓ 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, cardio respiratory endurance is the ability to perform endurance-type exercise such as (distance running, cycling, swimming, etc.).
- ✓ The individuals that have achieved a high measure of cardio respiratory endurance are generally capable of performing 30 to 60 minutes of vigorous exercise without undue fatigue.

Muscle fitness

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

Muscular strength: Is the maximal ability of a muscle to generate force.

Muscular endurance: Muscular endurance is defined as the ability of a muscle to generate force over and over again.

Types of Muscle Contractions

1, **isotonic** (also called dynamic) that result in movement of a body part. example, lifting a dumbbell

Divided in to 3

- **Concentric contractions** (muscle shortening)
- **eccentric contraction** (muscle lengthens.)
- **Isokinetic muscle contractions** (muscle shortening or lengthening is regulated at a fixed, controlled rate.)

2, **isometric**. (also called static) requires the development of muscular tension but results in no movement of body parts.

Muscle Fiber Types

There are three types of skeletal muscle fibers:

1, Slow-Twitch Fibers:

- ✓ As the name implies slow-twitch fibers contract slowly and produce small amounts of force.
- ✓ these fibers are highly resistant to fatigue.
- ✓ ideally suited for a low-intensity prolonged exercise like walking or slow jogging.
- ✓ Further, because of their resistance to fatigue, most postural muscles are composed primarily of slow-twitch fibers.

2, Fast-Twitch Fibers:

- ✓ Contract rapidly and generate great amounts of force but fatigue quickly.
- ✓ These fibres are white and have a low aerobic capacity
- ✓ fast-twitch fibers are used during activities requiring rapid or forceful movement, such as jumping, sprinting, and weight lifting.

3, Intermediate Fibers:

- ✓ Are although more red in color, possess a combination of the characteristics of fast- and slow-twitch fibers.

Flexibility

- ✓ Flexibility is the ability to move joints freely through their full range of motion.
- ✓ three kinds of stretching techniques are commonly used to increase flexibility:
 - Ballistic, - not recommended
 - static, (20-30 se) (2-3 rep)
 - proprioceptive neuromuscular facilitation(PNF)

The contract relax method(antagonistic movement)

More effective than the two but it may require partner

Body composition

- ✓ The term body composition refers to the relative amounts of fat and lean body tissue (muscle, organs, bone) found in your body.

The three most important factors to maintain a healthy body fat percentage are:

1. Maintaining your lean muscle mass through routine strength training (minimum 2x/week for each muscle group)
2. Maintaining a healthy well-balanced diet that is low in fat (<30% of calories from fat)
3. Maintaining consistent sleep patterns (minimum 7 hours/night). Always seek the assistance of a medical or health and fitness professional for personal program guidance in reducing or managing your body fat.

Health risks associated with over fatness

Obesity has been elevated from a secondary to a primary risk factor for heart disease ,high blood pressure and blood lipids ,Diabetes

- Over fatnes. and obesity can contribute to degenerative disease, health problems, and even shortened life.
- The location of body fat can influence the health risk associated with obesity.
- Excessive abdominal fat and excessive fatness of the upper body ("Northern hemisphere")(android fat)can increase the risk of various diseases.
- Lower body fat("southern hemisphere"),(sometimes called the "pear" shape or gynoid fat because it is more characteristic of women than men.
- Visceral fat is located in the abdominal cavity as opposed to subcutaneous fat, which is located just under the skin.

Health risks associated with excessively low body fatness

- The most common disorders are

1, anorexia nervosa,

- characteristics of anorexia nervosa are fear of maturity and inaccurate body image.
- The anorexic starves him/ herself

2, bulimia,

- is a common eating disorder characterized by bingeing and purging

3, norexia athletica.

- ☒ The average healthy adult body fat range regardless of age is 15 to 20 percent for men and 20 to 25 percent for women.

How do people manage their body fat?

The three most important factors to maintain a healthy body fat percentage are:

4. Maintaining your lean muscle mass through routine strength training (minimum 2x/week for each muscle group)
5. Maintaining a healthy well-balanced diet that is low in fat (<30% of calories from fat)
6. Maintaining consistent sleep patterns (minimum 7 hours/night). Always seek the assistance of a medical or health and fitness professional for personal program guidance in reducing or managing your body fat.

How to calculate your THR (target heart rate)

First find $HR_{mx} = 220 - \text{age}$

then multiply the HR_{MX} by 0.70 for minimum THR

and multiply the HR_{MX} by 0.90 for maximum THR

example ; - find the THR of the 19 years old student

$$HR_{mx} = 220 - 19 = 201$$

$$\text{Min-THR} = 201 \times 0.70 = 140.7$$

$\text{max-THR} = 201 \times 0.90 = 180.9$ so the 19 years old student heart beat must be min 140.7 and maximum 180.9 to develop his cardiovascular endurance