Skill India
कौशल भारत-कुशल भारत

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

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B&WSSC
BEAUTY & WELLNESS
SECTOR SKILL COUNCIL

Participant Handbook

Sector
Beauty & Wellness

Sub-Sector
Personal Services-Fitness

Occupation
Fitness Services

Reference ID: **BWS/Q3001, Version 3.0**
NSQF Level 3

Gym Assistant (B&W)

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> Skilling is building a better India. If we have to move India towards development then Skill Development should be our mission.

Shri Narendra Modi
Prime Minister of India


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A special thanks to Mrs. Lagan McPereira & Mr. Chirag Sethi for helping with content creation.

About this book

The overall Fitness Industry in India is growing at a CAGR of 19%. This growth is primarily driven by the increasing focus on personal health & well-being by following the road of prevention rather than cure. Increased emphasis on a holistic wellbeing with people's desire to look good and young are other motivators for the beauty and wellness industry. With a shift in focus towards quality of service, the industry has been looking to hire skilled workforce to sustain growth.

This Participant Handbook is designed to enable theoretical and practical training to become a Gym Assistant (B&W). The Qualification Pack of a Gym Assistant (B&W) includes the following National Occupational Standards which have all been covered in this Trainee Manual:

1. BWS/N9001 - Prepare and maintain work area.
2. BWS/N3001 - Assist/Demonstrate exercises to the client
3. BWS/N9002 - Maintain health and safety of workplace
4. BWS/N9003 - Create a positive impression at the workplace
5. Employability Skills

The key learning objectives and the skills gained by the participant are defined in their respective units.

We would also like to acknowledge the efforts put in by the B&WSSC team, master trainers, consultants and our Industry Partners like Classic Fitness who gave their valuable inputs in making this Participant Handbook. We hope that this Participant Handbook will be able to provide a sound learning support to our friends to aspire to build their career in the beauty and wellness industry.

Symbols Used


Key Learning Outcomes


Steps


Time


Tips


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Unit Objectives

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1. Introduction

Bridge Module

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. State the objectives of this program
2. Understand the beauty and wellness industry in India
3. State the growth opportunities that exist in the beauty and wellness sector

UNIT 1.1: Objective Of This Program

Unit Objectives

At the end of this unit, the participant will be able to:

1. State your roles and responsibilities of a gym assistant
2. State the attributes needed for a gym assistant

1.1.1 Introduction

Welcome participants to this program for gym assistants. From now onwards, you will be a part of a very fit and healthy industry. In India today, people are very conscious of their health. For everyone "Health is Wealth"! Exercise is the best way to remain active and fit. As a Gym Assistant, you will have varied responsibilities.

This course is designed for aspiring fitness experts in India. The curriculum encompasses sessions on anatomy, the physiology of exercise, inter personal skills etc. This course will prepare you to understand the client's needs in the gym, be punctual, handle gym equipment and be disciplined.

Best of luck in your journey towards making a fitter and better India!

1.1.2 Gym Assistant (Roles & Responsibilities, Attributes)

As a Gym Assistant you should have complete knowledge of the rules and regulations that have to be followed as a member of the staff. These rules and regulations will include membership rules of your gym, the different type of memberships etc.

As a gym assistant you will deal with many clients on a personal level, so you will also need to be courteous, discreet and polite at all times. You will make sure that decorum is maintained and guidelines are followed.

Figure 1.1.2 Gym Assistant at Work

As a Gym Assistant your roles and responsibilities will include:

1. Preparing and maintaining the work area
2. Assisting/ Demonstrating exercises to the clients
3. Maintaining health and safety of workplace
4. Creating a positive impression at the workplace

Notes

UNIT 1.2: Beauty and Wellness Industry

Unit Objectives

At the end of this module, the participant will be able to:

1. State the growth of beauty and wellness industry in India.
2. List the trends in the beauty and wellness industry in India.

1.2.1 Overview of the Beauty and Wellness Industry

According to the Beauty and Wellness Sector Skill Council, *"The wellness industry in India is poised to touch INR. 1,00,000 crore (INR. 1 trillion) by 2015, with a compounded annual growth rate of 15-17%, from about INR. 70,000 crore in 2012 , with a likely shortage of ~600,000 skilled personnel by 2016. FICCI-PwC report had forecast that the number of people employed in the Wellness space could potentially almost treble from over 1 million lakh in 2011 to 3 million by 2015"*.

According to a PWC report, *"The Indian wellness consumer can be classified into four broad categories— 'passives', 'beginners', 'actives' and 'believers'-depending on factors such as intent and extent of spend on wellness services and products, exposure to wellness concepts and importance given to wellness in their daily lifestyle. The 'passives' represent the largest volume opportunity, the 'beginners' are the fastest growing category, while the 'actives' and 'believers' together comprise only a small fraction of the population. These categories offer varying levels of opportunity for health and wellness players"*.

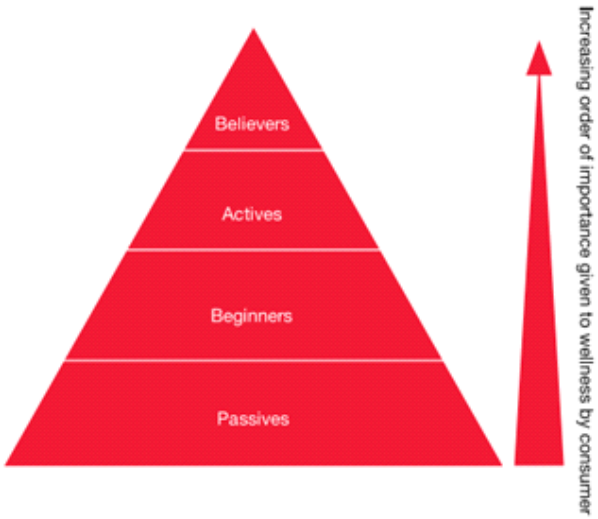

Figure 1.2.1 Wellness Consumer Pyramid

1.2.2 Key Trends In The Industry:

The key trends in the Beauty & Wellness sector are:

- Health and wellness has moved from being a part of the upper class society to the masses.
- Smaller towns and cities have become the hubs of health and fitness.
- Keeping fit is not a man's world anymore. Celebrities such as Priyanka Chopra and Shilpa Shetty are the fitness icons for women in India.
- People still want to follow traditional mode of fitness but they are open to modern means of attaining fitness as well.
- Indian consumers have become brand conscious today. Fitness brand s like the Gold Gym has taken the industry by a storm.

Notes

UNIT 1.3: Introduction To Fitness

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the segments that exist in the fitness segment
2. Explore the career opportunities in the fitness segment
3. Understand the projected growth and requirements in the fitness industry

1.3.1 About Fitness

Beauty industry can be divided into three segments: Cosmetic products, Beauty salons and Cosmetic treatments.

In the same way, the fitness industry can be divided into the following segments:

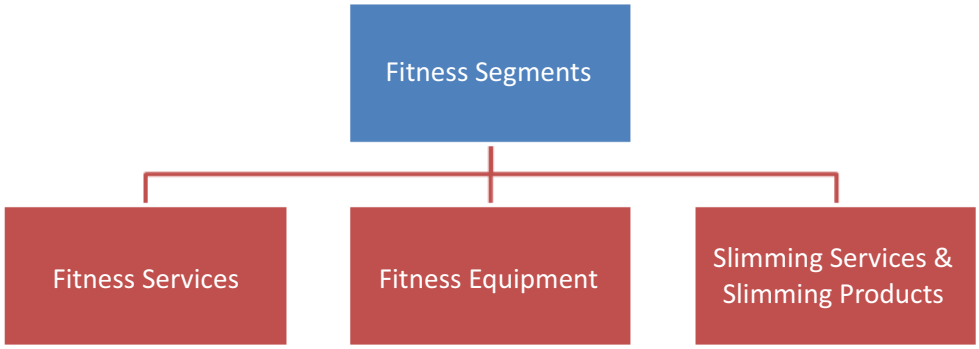

Fig. 1.3.1 Types of Fitness Segments

1.3.2 Career Opportunities

If you are the kind who likes to sweat it out in the gym, then this job is for you! You job requires you to be committed towards your body and mind to achieve true fitness. As a successful fitness expert you can be:

- Trainer in schools, colleges and universities
- Fitness instructor in five star hotel or resort, health spas or fitness clubs
- Personal trainer for an actor/ actress / celebrity

Fig.1.3.2 Fitness Trainer

1.3.3 Projected Growth And Requirement:

The fitness industry includes salons, gyms and fitness centres. Let us look at the growth and future requirement for fitness services in India:

- Fitness is here to stay. Well known fitness brands such as 'Gold's Gym' 'Burn Gym', 'Snap Fitness' are establishing centres in India and abroad.
- As per reports, the beauty and wellness market is around 500 billion and the fitness services account for 40 percent of the share.
- Right now, India is a young country with a large population in the age bracket of 20's – 30's. As they age and reach their 40`s in the next decade, there will be huge demand for health and wellness solutions. Therefore, the next decades are set to see a huge demand for fitness experts and health gurus.
- Internet offers immense opportunities for online instruction models by fitness experts

1.3.4 Preventive Aspect Of fitness

Regular physical activity, fitness, and exercise are critically important for the health and well being of people of all ages. Research has demonstrated that virtually all individuals can benefit from regular physical activity, whether they participate in vigorous exercise or some type of moderate health-enhancing physical activity

Being fit & doing regular physical activity can help reduce your risk for several diseases and health conditions and improve your overall quality of life. Regular physical activity can help protect you from the following health problems.

- **Heart Disease and Stroke:** Daily physical activity can help prevent heart disease and stroke by strengthening your heart muscle, lowering your blood pressure, raising your high-density lipoprotein (HDL) levels (good cholesterol) and lowering low-density lipoprotein (LDL) levels (bad cholesterol), improving blood flow, and increasing your heart's working capacity.
- **High Blood Pressure:** Regular physical activity can reduce blood pressure in those with high blood pressure levels. Physical activity reduces body fat, which is associated with high blood pressure.
- **Noninsulin-Dependent Diabetes:** By reducing body fat, physical activity can help to prevent and control this type of diabetes.
- **Obesity:** Physical activity helps to reduce body fat by building or preserving muscle mass and improving the body's ability to use calories. When physical activity is combined with proper nutrition, it can help control weight and prevent obesity, a major risk factor for many diseases.
- **Back Pain:** By increasing muscle strength and endurance and improving flexibility and posture, regular exercise helps to prevent back pain.
- **Osteoporosis:** Regular weight-bearing exercise promotes bone formation and may prevent many forms of bone loss associated with aging.
- **Self Esteem and Stress Management:** Studies on the psychological effects of exercise have found that regular physical activity can improve your mood and the way you feel about yourself. Researchers have found that exercise is likely to reduce depression and anxiety and help you to better manage stress.
- **Disability:** Running and aerobic exercise have been shown to postpone the development of disability in older adults and maintains quality of life longer for seniors.

Exercise

Answer the following questions:

A. ***Tick on the correct answer***

1. This course is designed to train you in the field of

a. Fitness and training
b. Fitness and beauty
c. Spa and beauty
d. Sports and beauty

2. As a successful fitness expert you can work as a

a. Trainer/ Personal Trainer / Fitness Instructor
b. Teacher / Tuition teacher / Fitness Instructor
c. Personal Trainer/ Language Expert/ Fitness Instructor
d. Sports Trainer/ Tuition Teacher/ Fitness Instructor

B. State the four most important roles and responsibilities of a gym trainer.

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2. Prepare nd Maintain Work Area

Unit 2.1 - How does gym floor look like

Unit 2.2 - Basic handling of gym equipment

Unit 2.3 - Reading schedule cards

Unit 2.4 - Prepare the service work area

Unit 2.5 - Personal presentation and behaviour

Unit 2.6 - Storage and Maintenance of records and equipment

(BWS/N9001)

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Demonstrate how to prepare and maintain the work area and the gym equipment
2. Demonstrate how to read schedule cards
3. Explain how to take care of clients needs in the gym
4. Understand how to be presentable at work
5. Demonstrate how to store and maintain records and equipment storage and maintenance of records and equipment

UNIT 2.1:How Does Gym Floor Look Like?

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the things to be considered while planning a layout space
2. State the things to be considered while surveying the floor
3. Understand what an underlay is
4. State the flooring and equipment lifecycle
5. List the different type of floors
6. State how to exercise budget options while choosing a floor

2.1 Planning A Layout Space

Gym flooring is an important part of the gym. The flooring done for fitness is special and laying the floor should be planned at the very beginning. The gym is divided into different zones of free weights, cardio or functional zone. So, the floor in each zone needs to be planned keeping these activities in mind.

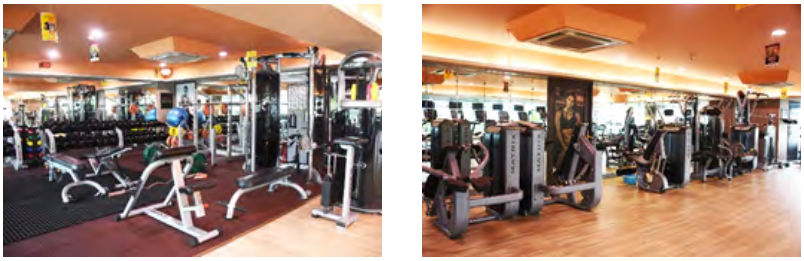

Fig. 2.1. Gym Layout

2.1.1 Things To Consider While Planning The Layout Space:

1. Is it a new project or under renovation?
2. Have the zones to keep each equipment been identifies? (Choose your equipment only after the zones have been allocated)
3. What are the types of equipments that will be put in each zone?

2.1.2 Surveying The Floor

It is essential to know what kind of flooring has been placed earlier.

Things to consider while surveying the floor:

1. What is the top layer made of?
2. How has the flooring been constructed, is the floor concrete, a raised floor or wooden?
3. Does the floor need to be reviewed?
4. Will any pre- preparation be required to the underlay in before laying a new floor?

2.1.3 Underlay

The underlay will be wholly built upon the level and extent of usage within the zone or area. Underlaysare usually done in certain zones like the free weight zone where an increased level of absorption is needed. These are zones where the floor can be damaged easily due to impact of falling weight.

2.1.4 Flooring And Equipment Life Cycle

Fitness equipment generally lasts for 3, 5 or 7 years. This depends totally on how much the equipment has been used, the brand and its specification. The cost of the flooring should be considered during the fit out stage. This is important as the flooring will then be compatible with the equipment used and will not need to be replaced before the equipment.

2.1.5 Types Of flooring

Gym floor need to be very flexible and easy to maintain.

The three type of flooring are:

Flooring rolls / Pad and Pour Flooring

- They are cheaper
- They are easier to install
- They are made in varying lengths
- They give a smoother look to the floor
- There are fewer joins and gaps
- They do not become loose when walked on
- They come in a wide variety of colours
- It is highly shock absorbable

Fig. 2.1.5 (a) Flooring Rolls

Gym Floor Tiles

- Most commonly used are the square tiles
- They have to be normally fastened to the floor as they do not interlock
- The edges need to be meticulously fixed to make sure there are no gaps.

Fig. 2.1.5 (b) Gym Floor Tiles

Interlocking Floor Tiles

- These tiles have a jigsaw locking system
- They are so heavy that the installation is perfectly secure without the use of adhesives

Fig. 2.1.5 (c) Interlocking Floor Tiles

Scan this QR Code to access the related video

Wooden Flooring

- It is natural, durable and environment friendly
- It is good to look at and can be easily repaired
- It needs to be dry mopped and swept daily
- It is long lasting but moisture and humidity can damage the wood, so not recommended in humid climate
- It is good for people with allergies

Fig. 2.1.5 (d) Wooden Flooring

Vinyl Flooring

- It is the cheapest gym floor option
- It is available in different colors and patterns
- It does not need much cleaning and maintenance
- It can last up to twenty years but is difficult to repair

Fig. 2.1.5 (e) Vinyl Flooring

2.1.6 Gym Floor Colour And Custom Designs

Nowadays the gym floor is custom designed as per each zone. The colour choice on the floor depends on the workout zone, the usage and the kind of cleaning required in each zone. It is important to check how the flooring colour merges with the rest of the floor around it. This is important to avoid any trips or falls or overlaps between two areas of the flooring.

2.1.7 Budget

Many options and choice of flooring will be available in the market. Always check your budget and the quality of the flooring product before buying. Initially, the flooring may look expensive but it is important to invest in a good quality floor as it will protect the floor underneath and the equipment as well. Again, you will have to consider the cost of the flooring with usage of each zone.

2.1.8 Floor Maintenance & Cleaner

Screening & Finishing: The procedure is also called refinishing. It should be done annually to preserve and maintain a traditional wood floor. Re-finishing a traditional wood floor gives it a shiny and clean look.

Notes

Unit 2.2 – Basic Handling Of Gym Equipment

Unit Objectives

At the end of this unit, the participant will be able to:

1. List the different types of gym equipment.
2. Demonstrate how to take care of gym equipment

2.2.1 List Of Gym Equipment

There are many gym related stresses and strains, which people suffer. To put a stop to this, you need to get your thorough knowledge about different equipment and work them to your strength to avoid injury and maximize your benefit. There are two main categories of equipment – Basic Gym Equipment and Versatile Gym Equipment.

Basic Gym Equipment	Description
Power Rack (Squat Rack/ Squat Station) 	Power Rack is an equipment that is designed to allow for spotter free safe weight training using a loaded barbell. Power Rack offers everything you need for an all-around workout. It is one the best equipment for strength training. It can be hard for the beginners, but important nonetheless.
Barbells 	Barbell is an equipment used in weight training, bodybuilding and strength training. It consists of a long bar with weights attached at both the ends. It is mandatory to purchase barbells if you have a power rack.

Bench Press 	Bench Press is one of the most popular fitness equipment. Bench Press is strength-training equipment used for building and toning the upper body.
Incline Press Bench 	Incline Press Bench is a strength-training equipment. It's a variation of the original, it engages the chest and fronts of the shoulders.
Hammer Strength Machine 	Hammer Strength Machine is rugged performance strength training equipment. People from competitive sports generally use it. This machine focuses on explosive movement and power.
Cables and Pulleys (Cable crossover machine) 	Cables and Pulleys is a strong framework that has grips that are attached to cables which in turn are connected to weights. One can perform a variety of exercises with this.

Dumb Bells 	Dumb bells is a definitive tool for strength training. It has strong handle with adequate knurling for grip and weights attached on both ends.
Pull-up Bar/Chin-up Bar 	Pull-up Bar is a horizontal bar with supports on which you pull yourself up, ideally chin above the bar.
Lat Pull Down Machine 	Pull Down Machine is another strength training exercise machine. In this equipment, the pulling action towards your chest for total upper body workout front and back.
Leg Extension Machine 	Leg Extension Machine is an ideal machine for toning your quadriceps. You will have to sit on the machine with your legs under the pads and lift weights using your quadriceps.

Leg Curl Machine 	Leg Curl Machine is an ideal machine to add to lower body circuit. It allows users to concentrate tension on the thighs from a comfortable seated position, or the hamstrings in an easy lying position.
Hyper Extension Bench 	Hyper Extension Bench helps you to perform more repetitions of squat and deadlift. It helps in strengthening the lower back.
Dipping Bar 	Dipping Bar is the best gym equipment that helps you build upper body muscles and strength.
Smith Machine 	Smith Machine is a weight training machine which will assist you in lifting weights and in performing squats. The machine has a barbell, which is fixed within steel rails allowing vertical movements.

Preacher Bench 	Preacher Bench is the ideal machine to build your biceps. You can increase muscle mass by lifting the barbell up and down. The machine has an elbow budding, a bar rest, and a seat.
Abdominal Bench 	Abdominal Bench is similar to Hyper Extension Bench which targets your abs. It is mainly used in performing squats and weight training. It is highly recommended that you maintain optimal posture while working out.
Leg Press Machine 	Leg Press Machine is the ultimate machine to work your leg muscles. You will have to push the platform of weights upwards as you lie down with your back against a support or a seat.
Hack Squat Machine 	Hack Squat Machine is another fitness device that can give your legs a good workout. It is essentially a combination of leg press and squat machines. It works your quadriceps in a much more efficient way.

Calf Machines 	Calf Machine can isolate the soleus muscles of the calves and give it a good workout. Your calves get a more muscular appearance when you work the soleus muscles.
Leg Abduction/Abduction Machine 	Abduction Machine is a popular machine among women as it helps to tone the legs and glutes.
Pec Deck Machine 	Pec Deck Machine is one of the best machine to isolate your pectoral muscles and give them a good workout. You can perform many exercises such as chest flys, butterfly, etc.
Ab Coaster 	Ab coaster machine works your abs from the bottom up, by targeting those hard to reach ab muscles. It can maximize your core workout by working your abdominal muscles.

Stretching Machine 	Stretching Machines are ergonomically designed devices to make stretching movements easier and more efficient. They are ideal for athletes and useful for preventing sport-related injuries.
Treadmill 	Treadmill is the first to come to mind, when you think of cardio workouts. They are used to help you achieve a walking or running motion while staying in one place. Using a treadmill regularly can help you lose weight and build strength.
Recumbent Bikes 	Recumbent Bikes are designed to give you great cardiovascular workout. They differ from other stationary bikes as the rider is in a reclining position when working out. This allows the rider's weight to be distributed comfortably over a larger area.
Stationary Bike 	Stationary Bike is one of the oldest equipment. It has been around since forever but you'll still find them in all gyms because it is very effective.

Versatile Gym Equipment	Description
Stability Ball 	Stability Ball is a giant inflatable rubber ball that can help you perform balance-training exercises such as planks. It also helps in stretching. It is a versatile tool, which is excellent for insulating your core.
Handgrip Exerciser 	Mechanical Handgrips are inexpensive training devices that can help you build hand strength. They are thick springs with handles on them that isolate the muscles associated with grip strength.
Balance Boards 	Balance Board is an essential equipment in balance training, active exercise, and other athletic training.
Foam Roller 	Foam Roller are useful to help you with your workout routines. It helps treat the muscle soreness. Foam Roller promotes flexibility and relax overactive muscles.

Wall Ball 	Wall Ball is used to build the core and lower body strength. All you have to do is fling the ball against a wall and catch it. You can combine this with sit-ups for better results.
Kettlebells 	Kettlebell is one of the most ancient and efficient strength training equipment. It consist of an iron ball with a handle, there are many exercises which you can do using a Kettlebell.
Jump Rope 	Jump Rope is a fitness tool that provides a total body conditioning and strengthening workout. It is a simple device that helps you burn more calories than many other forms of exercise
Resistance Bands 	Resistance Bands are elastic bands that allow you to perform strength-training exercises without weights. They allow you to add variety and intensity to your training and can deliver a full body workout.

Yoga Mat 	Yoga Mats are used in the practice of yoga to keep your feet and hands in place when performing an asana. Today Yoga Mats come in many different materials and finishes such as cotton, jute and rubber.
Battle Ropes 	Battle Ropes gives you full body strength training, enhances your fatigue resistance and helps your twitch muscles. It has become one of the commonly used tool in gym these days and adds an element of cardio to resistance workouts.
Medicine Balls 	Medicine Ball is also called a med ball, exercise ball or a fitness ball. It is a weighted ball which is used in a number of exercise movements to improve fitness, strength and coordination. It is also used for helping people recover from various types of injury.
Ankle Weight 	Ankle Weight is a well-cushioned weight-bracelet for your ankle which is used to add resistance to your exercises.

Pull up Bands	Considering pull ups are one of the best exercises for your upper body and these bands can help making it a lot easier for you if you are just getting into it.

2.2.2 Cleaning of Gym Equipment

Gym equipment is not a personal tool and is used by many. Keeping it clean and disinfected all the time will prevent the spread of communicable diseases, bacteria and viruses. This is one of the most important tasks of an assistant gym trainer. Let us look at a few procedures adopted to keep the gym equipment sparkling clean and the members happy and healthy!

The three type of flooring are:

Wipe Downs

Do's:

- With a wet mop and disinfectant wipe down all the mats, seats, pads, benches and cardio consoles
- Wipe the above equipment multiple times everyday
- Post signage everywhere in the gym, requesting the members to wipe the equipment after use
- Provide the members with paper towels and dispensers

Fig. 2.2.2 (a) Cleaning of Gym Equipments

Don'ts:

- Do not spray the disinfectant into the air. Spray directly on the mop and the wipe.

Oil Machines

Do's:

- The moving parts of the resistance machines should be oiled once in a month
- Spray silicone into a clean rag and apply it to the weight tracks and resistance equipment to clean it
- Spray silicon into the bearing. To ensure free movement of the bearings, spray silicon
- Move and check to ensure they are moving feely
- Check the oil reservoirs of cardio vascular machines and fill them according to the manufactures' instructions manual

Fig. 2.2.2 (b) Cleaning of Oil Machines

Maintain Adjustable Barbells

Do's:

- Use a wire brush to clean the dirt, dead skin, rust and lifting chalk that gathers in barbell's knurling
- Clean the barbells once in a week
- Oil the bearing of the barbells every week so that the sleeves can spin freely

Checking Equipment for Wear and Tear

1. Every week walk through the entire facility to check worn out or broken equipment
2. Check for cracks and tears in machine and bench pads
3. Check the cables spot any fraying or tears in the rubber coating
4. Examine the fixed barbells and dumbbells to ensure that they are securely attached
5. Repair or replace any equipment that could lead to safety hazard immediately

Notes

Unit 2.3 – Reading Schedule Cards

Unit Objectives

At the end of this module, the participant will be able to:

1. State the guidelines for creating a schedule card
2. Write a schedule card

2.3.1 Guidelines For Creating A Schedule Card:

Fitness is a program. Like any other activity that you plan for work, study or leisure, fitness programs need to be developed well. This is important as fitness levels different from person to person. A Schedule card in a gym is a timetable or a planner created to assist a person to perform exercise in a given manner. The head trainer of a gym usually makes the schedule cards. It is a part of the rules that the Gym Assistant (B&W) has to follow.

- Schedule cards can be made for the month, week or as per the exercise regime that a person has to follow.
- Schedule cards should be designed keeping the goals, current fitness levels and medical conditions of a person.
- Schedule cards should also track a person's blood sugar, blood pressure and BMI.
- Separate schedule cards should be created for the diet a person has to follow while workout.
- Gym Assistant (B&W) should have a basic knowledge of muscles.
- Gym Assistant (B&W) should be able to demonstrate good form and technique of all exercises whether it is body weight or equipment.
- Gym Assistant (B&W) should have knowledge of basic medical conditions in order to follow the schedule cards.

2.3.2 Sample Schedule Card:

Personal Workout Plan for the Month - August 2017						
Name						
Monthly Goal						
Legend	PT - Sessions	C - Cardio	F - Flexibility	W - Weights		
Week 1						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 2						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 3						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Week 4						
Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Measurements						
Beginning of the Month			End of the Month			
Weight			Weight			
Inches			Inches			

Unit 2.4 – Prepare The Service Work Area

Unit Objectives

At the end of this module, the participant will be able to:

1. State the guidelines to prepare the service area

2.4.1 Guidelines To Prepare The Service Work Area

It is the Gym Assistant's job to take care of the service work area where exercises are performed. The Gym Assistant (B&W) has to make rounds and do a daily check to see that everything is in order.

A Gym Assistant (B&W) should:

- Check temperature and lighting in the gym
- Identify any immediate hazards such as leaks and electrical problems on the gym floor. If there is an issue then the maintenance staff should be notified immediately.
- Check for damaged equipment like broken or frayed cables and tubes, chipped dumbbells and barbells, torn ground mats and deflated or damaged inflatable equipment such as stability ball, BOSU, etc.
- Follow-up with staff members regarding the status of malfunctioning equipment
- Preventing members from using a damaged piece of equipment by placing them on side
- Make sure all equipment pieces like dumbbells, barbells, plates, medicine ball, etc. are put back in their designated place
- Make sure that all main pathways or gym floor is clear of equipment. This is for the safety of clients

Notes

Unit 2.5 Personal Presentation & Behaviour

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the guidelines to follow for personal presentation
2. Follow the guidelines for good behaviour

Remember the first impression is the last. As a working professional, your look should always be neat and clean. Wearing good clothes does not necessarily mean that you are well groomed. A well-groomed person should also possess good personal hygiene habits.

2.5.1 Guidelines for Personal Presentation

A Gym Assistant (B&W):

- Must take a bath everyday in the morning before coming to the gym floor
- Should wear clothes that are fresh, clean and ironed especially the gym uniform
- Should get a good haircut from time to time
- Should always trim the nails of his/her hand and feet
- Maintain good oral hygiene
- Carry a mouth freshener as it is important to prevent bad breath
- Carry deodorants to prevent body odour

2.5.2 Guidelines for Good Behaviour

It is necessary to build a bond with members of the gym. To do this you need to have good interpersonal communication skills. Here are few tips that will help you in your behaviour:

- Always smile and greet members
- Always be warm, caring, respectful and approachable
- Always have a positive attitude. The members should respect and trust you.
- Always be attentive while assisting members
- Always keep your mobile phones away from the exercise floor as it shows a non-caring attitude
- Always keep a respectable distance between yourself and gym members while assisting and talking to them.
- Always take the permission of gym members before touching them (If needed during exercise)
- Always give clear and concise replies to queries by gym members
- Do not share personal information about the gym members with other gym staff.
- Do not gossip.

Unit 2.6: Storage and Maintenance of Records and Equipment

Unit Objectives

At the end of this unit, the participant will be able to:

1. Demonstrate how to maintain records

2.6.1 Maintain and Store the Records

Every organisation has to maintain records of their business activities. A gym is a service centre where people come for fitness and rejuvenation. Some of the information that the gym members share is personal in nature. It is essential to maintain the privacy of the clients.

- Personal information about members should be filed. These files should be keptunder lock and key. Access to these files should be restricted.
- The gym members provide information about themselves such as health history, goals, and any new medical conditions. This data should be updated regularly every year. It is the responsibility of the head trainer and personal trainer to do this.

Summary

- Gym flooring is an important part of the gym. The flooring done for fitness is special and laying the floor should be planned at the very beginning.
- Keep the gym equipment clean and disinfected all the time will prevent the spread of communicable diseases, bacteria and viruses.
- Make sure that the schedule cards of clients are prepared and training is done as per individual needs.
- Keeping the service area workable and in order is a part of the role of the assistant gym trainer.
- As a working professional your look should always be neat and clean. Always remember first impression is the last impression.
- Good behaviour is also an essential part of personal presentation. Polite and discreet behaviour will always be appreciated by the clients.
- The gym members provide information about themselves such as health history, goals, and any new medical conditions. These files should be kept under lock and key. Access to these files should be restricted.

Notes

Exercise

Answer the following questions:

1. The gym is divided into different zones of _____, _____ or _____.

   a. Free weights, cardio or functional zone
   b. Free weights, cardio or resting zone
   c. Free weights, cardio or dancing zone
   d. Free weights, cardio or talking zone

2. _____ are usually done in certain zones zone where an increased level of absorption is needed.

   a. Overlays
   b. Underlays
   c. Flooring rolls
   d. Pad flooring

3. Wooden flooring is not recommended in _____ climate.

   a. Dry
   b. Humid
   c. Cold

4. The moving parts of the resistance machines should be oiled_____ in a month.

   a. Once
   b. Twice
   c. Thrice
   d. Four times

5. _____should be designed keeping the goals, current fitness levels and medical conditions of a person.

   a. Report Cards
   b. Greeting Cards
   c. Schedule Cards
   d. Invitation Cards

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3. Assist / Demonstrate Exercises To The Clients

Unit 3.1 – Basics of Anatomy & Physiology of Human Body
Unit 3.2 – Skeletal System
Unit 3.3 – Muscular System
Unit 3.4 – Cardiovascular System
Unit 3.5 – Biomechanics (Basics)
Unit 3.6 – Concept of Physical Fitness
Unit 3.7 – BMI
Unit 3.8 – Exercise Physiology
Unit 3.9 – Types of Gym Exercises
Unit 3.10 – Nervous System
Unit 3.11 – Acute and Chronic Response to Training

(BWS/N3001)

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Understand the basics of anatomy
2. State the function and composition of the skeletal system
3. Understand the muscular system
4. Understand the cardiovascular system
5. Explain the principles and techniques of physical training
6. State the functions of the nervous system
7. Explain the acute and chronic responses of the body to CR and resistance exercise

Unit 3.1: Basics of Anatomy & Physiology of Human Body

Unit Objective

At the end of this unit, the participant will be able to:

1. List the words used in anatomy
2. Describe the type of joints and their movements

3.1.1 Anatomical Terminology

Anatomical terms are simply words that tell about a point in the body and its relation to other systems in our body. We use these words to tell the movement of the body. For example during an exercise , we will say that this person is standing erect with his head, eyes and palm facing upwards, his feet are slightly apart.

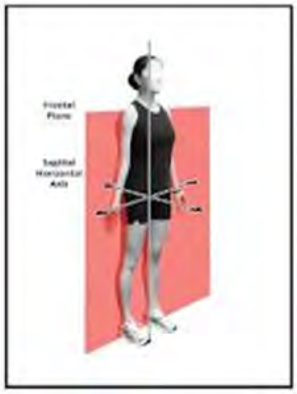
Look at the table below, some anatomical words and what they mean have been given for your reference.

Anterior / Ventral	Towards the front
Posterior / Dorsal	Towards the back
Superior	Towards the head
Inferior	Towards the feet
Medial	Near the middle of the body
Lateral	Away from the middle of the body
Proximal	Near the trunk
Distal	Away from the trunk
Superficial	Closer to the body surface
Deep	Beneath the body surface
Cervical	Region of the neck
Thoracic	Region between the neck and the abdomen
Lumbar	Region of the back between stomach and pelvic
Dorsal	Top surface of feet and hands
Palmar	Anterior surface of hands
Supination	Lying face up
Pronation	Lying face down

3.1.2 Movement Planes

Just like the earth is divided into imaginary lines when we study geography; similarly our body is divided into imaginary lines. These are lines drawn vertically and horizontally through an upright body. These lines divide the body into sections which makes it easy for us to distinguish between the body movements. These lines are called planes.

Dividing the body into planes will help us to devise better exercises based on movement of the body in real life. Given below is a chart of the three planes and the exercises that can be performed for each plane.

Name of the Plane	Picture of the Plane	Exercise as per Planes
Sagittal Plane - This plane divides the body into right and left halves	 SAGITTAL PLANE & SAGITTAL HORIZONTOL AXIS	Bicep curls Front and Reverse Lunges
Frontal / Coronal Plane – This plane divides into anterior and posterior parts	 FRONTAL PLANE & FRONTAL HORIZONTOL AXIS	Dumbbell lateral raise
Transverse / Horizontal Plane	 TRANSVERSE PLANE & VERTICAL AXIS	Horizontal wood chop

3.1.3 Joint Movement

All movements in our body happen in collaboration with the three planes of motion. These planes need to be considered to design any successful exercise routine. Each of these movements has a definite term. These movements occur in pairs and so there is a term to describe the opposite movement as well.

Types of Joint Movements

- Sagittal Plane Movements
- Frontal Plane Movements
- Transverse Plane Movements
- Multi-planar Movements

Notes

Unit 3.2: Skeletal System

Unit Objective

At the end of this unit, the participant will be able to:

1. State the functions of the skeletal system
2. Recall the composition of the skeletal system
3. Explain how bones are formed

3.2.1 Functions of the Skeletal System

The skeleton which makes the framework of our body is made up of 206 bones. These bones are have a hard and strong outer part and are spongy from inside. This spongy part is also called the bone marrow.

Fig 3.2.1 Anterior and Posterior View of Skeleton System

The functions of skeletal system are:

- To provide a framework to the body
- To provide support to the tissues so that an overall posture can be maintained
- To protect the internal organs from injuries. For example, the heart and lungs are protected by the ribcage
- To act as a lever to help move the bones and the muscles.
- To act as a storehouse for all the minerals that make the bones hard and rigid. For example, calcium, phosphorus, sodium and phosphate.
- To help in the production of the red blood cells (RBC) and the white blood cells (WBC) and platelets through the bone marrow.

3.2.2 Composition of the Skeletal System

The skeleton system is made up of connective tissues that are fibrous and full of minerals. These tissues help to make the bones firm and flexible. The skeleton system comprises of bones, cartilage, tendon, joints, ligaments and collagen. Phosphate and calcium are the minerals that make the bones rigid and give the compression strength. Collagen is tough elastic rope like fibre that provides elasticity and tensile strength to the bones.

Bones have two types of tissues Compact or Cortical Bone and Spongy or Trabecular Bone

Compact or Cortical Bone	**Spongy or Trabecular Bone**
This is the hard outer surface of the bone	This is porous in nature with a honeycomb like look
It is strong and dense with many layers	It is less dense
It provides strength and support for weight bearing	It provides a large surface area for mineral exchange. It helps in maintaining skeletal strength
The compact bone makes the large portion of the diaphysis (Shaft) that has two enlarged ends called epiphysis that is covered by articular cartilage.	The areas that comprise large percentage of trabecular bones are likely to fracture as bones become brittle with age
The hollow centre inside the diaphysis is called the medullary cavity. This is filled with yellow bone marrow and acts as a storage site for fat.	
The medullary cavity is lined with connective tissue called endosteum.	
A tough, fibrous connective tissue membrane called periosteum covers the outer layer of the diaphysis. This protects the bones. It is a point of attachment for muscles. It contains blood vessels that nourish underlying bones.	
A highly vascular inner layer contains cells for growth of the new bone.	
In children, a band of cartilage called the epiphyseal cartilage or growth plate is located between the diaphysis and epiphysis as they are still growing.	

3.2.3 Formation of Bones

The natural process of new bone formation is called “ossification”. The skeleton goes through a process where old bones are replaced with new ones. This process of remodelling happens in ten years. There are special cells that create the new bones. These cells are called “osteoblasts”. Another group of special cells break the old bones. These cells are called 'osteoclasts'.

Wolff's law – The structure and form of our bones changes as we get older. This happens as the bones are being constantly remodelled or rebuilt. Wolff's states that bones increase or decrease their mass to adapt to the stress being applied to them. Bones become thicker and stronger with continuous remodelling and resistive exercises. Exactly the opposite will occur if there is no exercise.

Osteoporosis is a condition of the bones where they become brittle and can fracture easily. This happens with age, as the rate of bone replacement is slower than the breakdown. This makes the bones dense and hence brittle.

The skeletal system has two main parts: Axial Skeleton and Appendicular Skeleton.

The Axial Skeleton

- The axial skeleton consists of 80 bones in the upper body. These include the cranium (skull), Hyoid bone, Vertebral column (spine), Sternum (breast bone) and the rib cage.
- The skull is made up of cranial and facial bones.
- A horseshoe shaped hyoid bone of the neck acts as movable base for the tongue It does not work like any other bone but helps the tongue in swallowing.
- The spine comprises of 26 bones and cartilage that extend from the base of the skull to the pelvis.
- The spine covers and protects the organs, the nervous system (brain and spinal cord) and supports the trunk of the body.
- The rib cage consists of 24 ribs. These ribs are present in pairs. They include the sternum (with xiphoid process), costal cartilages and the 12 thoracic vertebrae.

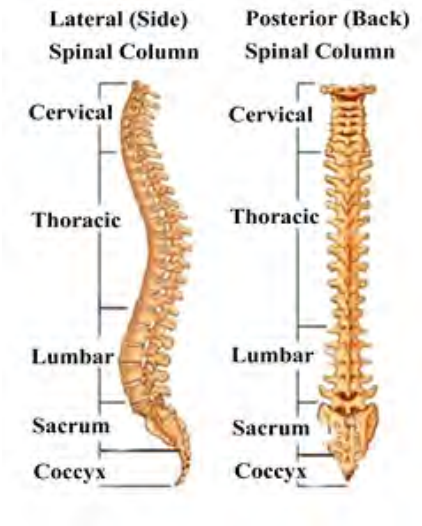


Fig. 3.2.3 (a) Lateral and Posterior view of Spinal Column

- The ribs form a cage around the heart and lungs, protecting them from injuries. The first seven pairs fuse with the sternum, or breastbone, in the front portion of the chest.
- The 8th through 10th ribs have non-costal cartilage that connects them to the ribs above. The last two pairs are called *“floating or free ribs”*.
- They are not attached to the sternum or other ribs via the cartilage instead they are attached to the vertebrae. Ribs number 1 to 7 increases in length and 8 to 12 decrease in length.

The Appendicular Skeleton

- The appendicular skeleton consists of bones that are related to appendages. These include the bones in the arms, shoulder, girdle, legs and pelvic girdle.
- A total of 126 bones make up the upper and lower part of the skeletal system. There are 64 bones in the upper body and 62 bones in the lower body.

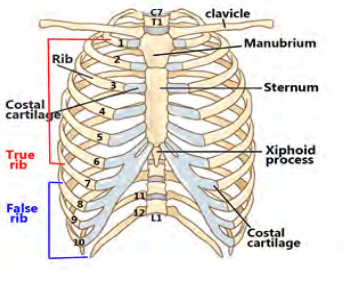


Fig. 3.2.3 (b) Appendicular Skeleton

- The shoulder girdle comprises of the collar bone (clavicle) and shoulder blade (scapula).These bones are attached to the upper extremity of the axial skeleton at the breast bone (sternum). This attachment is the only link between the upper extremity and the axial skeleton.
- The pelvic girdle comprises of the sacrum and the coccyx. The pelvic girdle connects the head of the femur to a cup shaped groove called the acetabulum. This in turn connects the hip to the lower appendages.

Fig. 3.2.3 (c) Appendicular Skeleton

Bones in the axial and appendicular skeleton

Axial Skeleton	No. of Bones	Appendicular Skeleton	No. of Bones
Skull	28	Shoulder girdle collar bone + shoulder blade	2 + 2
Cranium	8	Humerous	2
Facial Bones	14	Radius	2
Hyoid	1	Ulna	2
Vertebral column	26	Carpals	16
Cervical	7	Metacarpals	10
Thoracic	12	Phalanges	28
Lumbar	5	Pelvic Girdle	2
5 Fused bones of sacrum	1	Femur	2
4 Fused coccyx (tail) bone	1	Tibia	2
Ribs	24	Fibula	2
Sternum (breast bone)	1	Tarsals	14
		Metatarsals	10
TOTAL	80	**TOTAL**	96

Unit 3.3: Muscular System

Unit Objective

At the end of this unit, the participant will be able to:

1. State the function of the muscular system
2. Classify the different types of muscle tissue
3. Demonstrate the exercises for upper body muscles
4. Demonstrate the exercises for arms and fore-arms muscles
5. Demonstrate the exercises for trunk muscles

3.3.1 Function of the Muscular System

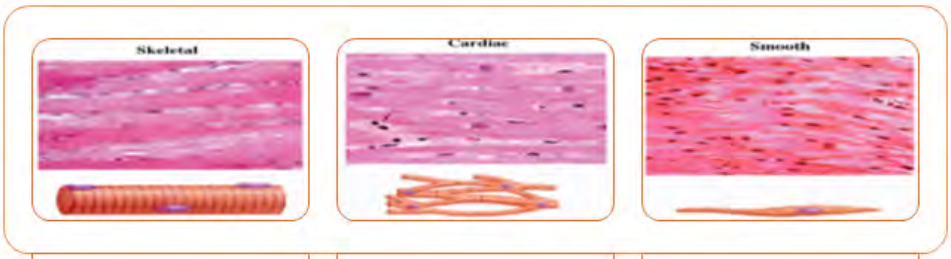
Our body consists of approximately 639 muscles. The chief function of the muscular system is movement. Muscles are the only tissues that can contract and so move the other parts of the body. Skeletal muscles are attached to bones through strong connective tissue called tendons. The ligaments attach bone to bone.

The function of the muscular system is:

- To help in movement
- To help in producing heat
- To help to maintain posture

3.3.2 Types of Muscle Tissue

There are two types of muscle tissues: voluntary and involuntary. Voluntary muscles are under our control, for example, skeletal muscles. Involuntary muscles are not under our control for example, cardiac and visceral muscles. These muscles are controlled by autonomous nervous systems.



Skeletal Muscle	Cardiac Muscles	Smooth Muscles
Only voluntary muscle tissue in the body Fibrous, striated in appearance with light and dark stripes	Involuntary muscle, found only in the heart Pumps blood throughout the body Striated in appearance	Are found inside the organs like stomach, intestines & blood vessels

Fig. 3.3.2 Types of Muscle Tissue

3.3.2.1 Agonist, Antagonist, Synergist and Stabilizer Muscles

Skeletal muscles work in group to carry out specific and precise movements.

Agonist Muscles: Agonist or prime movers are muscles that perform the required action at a particular joint. These agonist muscles work in combination with an antagonist muscle that produces the opposite effect on the same bones. For example, the biceps brachii muscle flexes the arm at the elbow. As the antagonist for this motion, the triceps brachii muscle extends the arm at the elbow. When the triceps is extending the arm, the biceps would be considered the antagonist.

Fig. 3.3.2.(a) Front and back view of body muscles

Synergist Muscles: These muscles indirectly help in performing a joint movement along with the agonist muscles. They are found in the areas close to the agonist muscles and usually connect to the same bones. E.g. during a bicep curl the synergist muscles are the brachioradialis and brachialis which assist the biceps to create the movement and stabilize the elbow joint.

Fixator or Stabilizer Muscles: These muscles help the agonist muscles to work better by assisting in movement and balancing the origin. For example, the rotator cuff muscles would work as stabilizers while performing bicep curls or while lifting something heavy with the arms, fixators in the trunk region hold your body upright and immobile so that you maintain your balance while lifting.

3.3.3 Muscles of the Upper Body

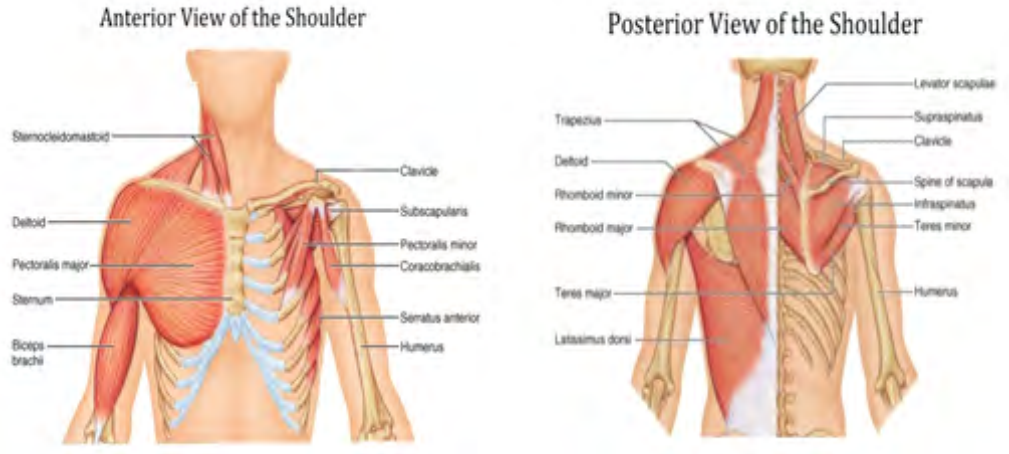


Fig. 3.3.3 (b). Anterior and Posterior View of Upper Body Muscles

The Shoulder

The shoulder is one of the most complex joints in the human body. The shoulder bone is made up of the humerous, the scapula (shoulder blade) and the clavicle (collar bone).The shoulder joint is formed by the combination of the head of the humerous with the clavicle and the scapula (Ball and Socket joint). The shoulder performs a wide range of motions (ROM). This range of motion sometimes occurs at a cost to stability and this can lead to injuries.

The four joints that make up the shoulder joints are:

- The Glenohumeral joint
- The Acromioclavicular joint (AC)
- The Sternoclavicular joint (SC) and
- The Scapulothoracic joint (ST)

Fig. 3.3.3 (c) Shoulder Muscles

The muscles of the shoulder region are categorised as shoulder joint muscles or shoulder girdle muscles. These two muscles work together to carry out the upper extremity movements. The shoulder joint muscles move the arms. The shoulder girdle muscles stabilize the scapula on the thoracic cage, their role is important in maintaining body posture.

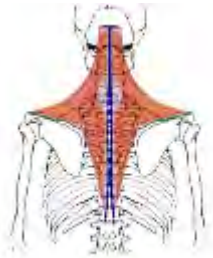
Movements of the Scapula	Movement of the Shoulder
Elevation/ Depression	Flexion/ Extension
Adduction/ Abduction	Adduction/ Abduction
Elevation/ Depression	Horizontal Adduction/ Abduction
Retraction/ Protraction	Internal/ External Rotation

3.3.3.1 Exercises for the Muscles of the Shoulder Joint

Name of the Muscle	Image	Function	Related Exercise
Deltoids 1. Anterior fibre 2. Medial Fibres 3. Posterior Fibres		Complete Muscle 1. Flexion 2. Internal rotation Horizontal adduction 3. Abduction Extension Horizontal abduction 4. External rotation	• Overhead press • Frontal raise • Lateral raise • Upright rows • Reverse flyes
Pectoralis Major		1. Shoulder flexion 2. Internal rotation Horizontal adduction	• Incline bench press • Push-ups • All bench presses

Latssimus Dorsi		1. Shoulder adduction Internal rotation 2. Extension 3. Horizontal adduction	• Lat pull downs • Chin-ups • Rowing exercises
Teres Major		Same as latssimus dorsi	Same as latssimus dorsi
Rotator Cuff muscles Supraspinatus Infraspinatus Teres minor Subscapularis		1. Abduction 2. External rotation Same as above 3. Internal rotation	Internal & external rotation exercises Games such as Tennis, Badminton & Volleyball

3.3.3.2 Exercises for the Muscles of the Shoulder Girdle

Name of the Muscle	Image	Function	Related Exercise
Trapezius Upper Fibers Middle Fibers Lower Fibers		1. Elevation & upward rotation of scapulae 2. Adduction & upward rotation of scapula 3. Depression of scapulae	• Shoulder Shrugs • Upright rows
Levator Scapulae		Elevation of scapulae	• Shoulder shrugs

Rhomboid major & minor		1. Adduction 2. Downward rotation Elevation of scapula	• Supported dumbbell bent over row • Chin-ups
Serratus Anterior	 	1. Stabilization 2. Abduction 3. Upward rotation of scapula	• Push-ups • Pull-overs • Bench press movements
Pectoralis Minor		1. Stabilization 2. Depression 3. Downward rotation Abduction of scapula	Same as Pectoralis major

3.3.4 Muscles of the Arms and Forearms

The elbow is made of three bones. These bones are joined together by muscles, ligaments and tendons. The large upper arm bone is called the humerous. The other two bones are called Ulna (medial side) and the radius (lateral or the thumb side). The medial and lateral epicondyles project from the end of the humerous. The epicondyles are the bony attachment sites for the forearm muscles. The bicep brachii, brachialis and brachioradialis muscles help in elbow flexion where as the triceps help in elbow extension.

The muscles that move the wrist, hand, and fingers are based in the forearm. These thin, strap-like muscles extend from the humerous, ulna and radius and insert into the carpals, metacarpals, and phalanges through the long tendons.

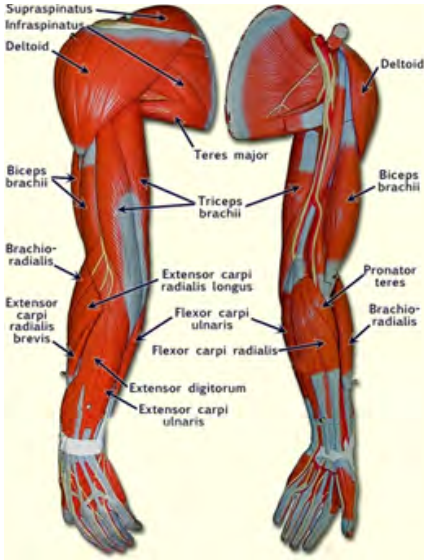


Fig 3.3.4 (d) Arms and Forearms Muscles

The forearm muscles comprise of the forearm flexors and extensors. The two special motions produced by the muscles of the forearm are supination and pronation of the forearm and hand.

3.3.4.1 Exercises for Muscles of the Arms and Forearms

Name of the Muscle	Image	Function	Related Exercise
Bicep Brachii		1. Elbow flexion 2. Supination at forearms	• Arm curls • Chin-ups • Rope climbing
Bicep Brachialis		1. Elbow flexion	Same as above
Brachioradialis		1. Elbow flexion 2. Supination at forearms	• Hammer curls
Triceps		1. Elbow flexion	• Close grip bench press • Overhead triceps extension
Pronator Teres		1. Elbow flexion 2. Pronation of forearm	• Reverse curls

Pronator Quadratus		1. Pronation of forearm	• Resisted pronation

3.3.5: Muscles of the Trunk

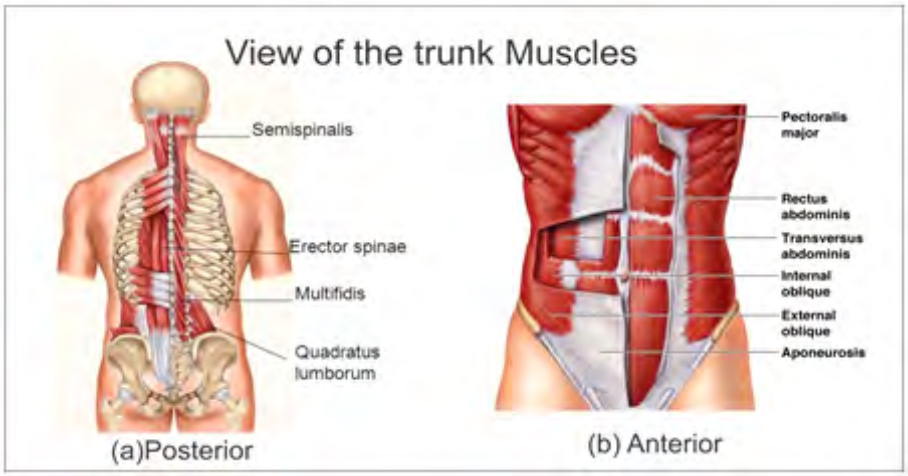


Fig 3.3.5 (c) Posterior and Anterior view of Trunk Muscles

The abdomen is very different from the thorax and pelvis because it does not have any bony cage to protect it. The wall of the abdomen is made up of muscles and tissues that hold it. Together with the spinal column it gives structure to the mid-section.

The three muscles that make up the abdominal wall are:

- The rectus abdominals
- The transverse abdominals
- The internal and external oblique

The main functions of abdominal muscles are:

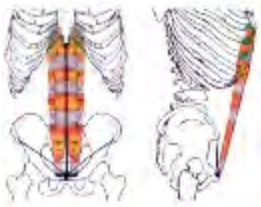
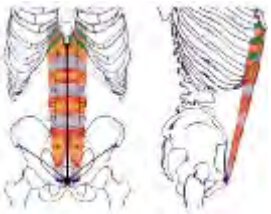
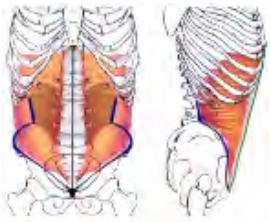
- To support the trunk
- To allow movement
- To hold internal organs in place by maintaining internal abdominal pressure
- To help in breathing
- To provide postural support

Vertebras are the single and specific bones of the spine. The vertebrae's are placed one on top of each other. This stack of vertebras becomes a hollow tube through which the spinal cord passes. The intervertebral discs are shaped like “round cushions” which act as shock absorbers between each vertebra. Each disc has a strong outer ring of fibres called the annalus (a strong ligament that connects each vertebra) and a soft jelly like centres called nucleus pulposus. Muscles are connected to the vertebrae and bones through ligaments. The erector spinae group helps in trunk extension.

The functions of the vertebra are:

- To protect and support the spinal cord
- To bear the weight of the spine

3.3.5.1 Exercises for the Trunk Muscles

Name of the Muscle	Image	Function	Related Exercise
Rectus Abdominis		1. Flexion 2. Lateral flexion of the spine	• Curl ups • bent knee sit-ups • reverse curls • pelvic tilt
External Oblique		1. Lateral flexion 2. Rotation to both sides and flexion	• Twisting curl ups • Rotation to opposite side
Internal Oblique		1. Lateral flexion 2. Rotation to both sides and flexion	• Dynamic Side planks • Bent knee side sit-ups
Transverse Abdominis		1. Compresses abdominal matter	• Supine pelvic tilts
Erector Spinae		1. Spinal extension 2. Lateral flexion 3. help in head rotation	• Prone machine extension • Hyperextensions

Notes

Unit 3.4: Cardiovascular System

Unit Objective

At the end of this unit, the participant will be able to:

1. State the functions of the cardiovascular system
2. Explain the features of the heart
3. Explain the functions of the heart
4. Explain the cardiac cycle
5. Classify the different types of blood vessels

3.4.1 Functions of Cardiovascular System

The cardiovascular system and the respiratory system work together. They deliver oxygen to the tissues in the body and remove carbon dioxide.

Cardiovascular system has two circuits:

Pulmonary Circuit

- Make up - Heart, Lungs, Pulmonary veins and Pulmonary arteries
- Function - Pumps deoxygenated blood from the heart to the lung where it becomes oxygenated and returns to the heart

Systematic Circuit

- Make up - Heart, Arteries, Arterioles, Capillaries, Venules and Veins
- Function - Pumps oxygenated blood to the tissues, muscles and organs in the body. This gives them the nutients and gases they need in order to function

The functions of the cardiovascular system are:

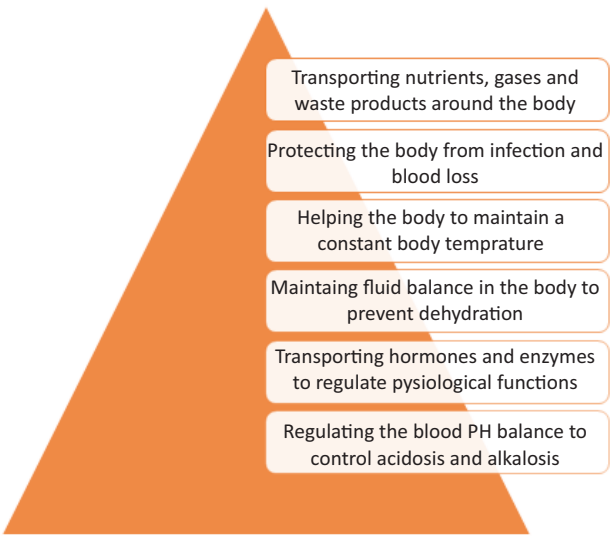


Fig 3.4.1 Functions of Cardiovascular System

3.4.2 Features of the Heart

Location: The heart is located between the lungs and behind the sternum. Two-third of the heart is located to the left of the midline of the body and one-third on the right side.

Shape: It is a muscle which is hollow and shaped like a cone. It is enclosed in a protective sac filled with fluid. This sac is called pericardium.

Size: It is the size of a fist.

Make up: The heart is made up of three specialised layers. They are:

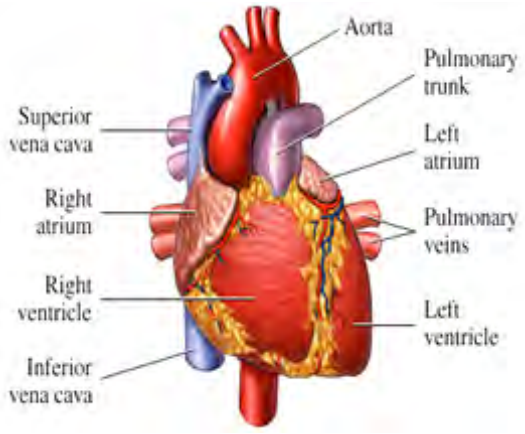


Fig 3.4.2. Heart

- **Endocardium:** It is the smooth inside lining of the heart.
- **Myocardium:** It does the major work of the heart. It is thicker and stronger in the left ventricle. It pumps blood to the rest of the body.
- **Epicardium:** A thin lining forms the outermost layer of the heart. It gets its blood supply from the chambers of the heart.

3.4.3 Functions of the Heart

Step 1:

The heart has two veins. All blood enters the right side of the heart through these two veins.

The superior vena cava – It collects blood from the upper half of the body.

The inferior vena cava – It collects blood from the lower half of the body.

Step 2:

Once the blood is collected, it enters the right atrium (RA).

Step 3:

The RA contracts and the blood go to the right ventricle through the tricuspid valve. When the RV contracts the blood is pumped through the pulmonary valve. From here it goes into thee pulmonary artery and the lungs. It picks up oxygen from the lungs.

Step 4:

Now the oxygenated blood returns to the heart from the lungs by way of the pulmonary veins and goes into the left atrium (LA).

Step 5:

The left ventricle contracts and blood moves through the mitral/bicuspid valve and into the left ventricle (LV).

Key Terms	
Left Ventricle (LV)	It is the chamber that pumps blood through the aortic valve into the aorta.
Aorta	It is the main artery of the body. It receives all the blood that the heart pumps and distributes it to the rest of the body.

3.4.4 Cardiac Cycle

One heartbeat is made of one contraction phase and one relaxation phase.

Systole	Diastole
This is the contraction phase	This is the relaxation phase
Occurs when the blood is pumped out of the heart	Occurs when the heart is relaxing and filling with blood

The sympathetic and parasympathetic branches of the nervous system control the contractions of the heart.

Branches of the Nervous System	
Sympathetic	Parasympathetic
It stimulates the heart to beat faster	It returns the heart rate to its normal resting level

3.4.5 Blood Vessels

Around four to five litres of blood is generally circulating in the human body. Blood is made up of two parts:

- Solid portion – Consists of red blood cells, white blood cells and platelets
- Liquid portion – Consists of plasma which is approximately 90% water

There are five types of blood vessels in the body. They are:

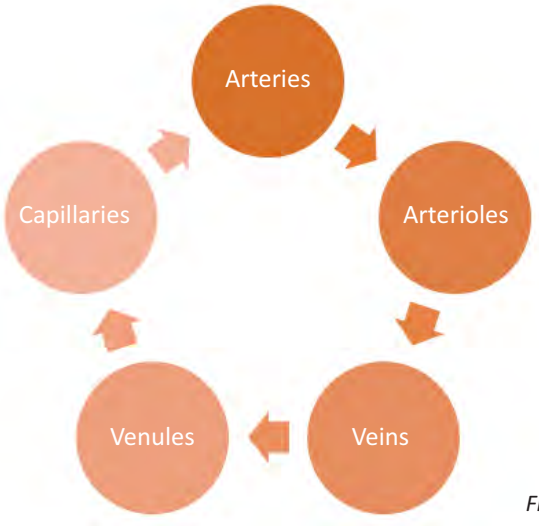


Fig 3.4.5 Types of blood vessels

Arteries and Arterioles: They carry oxygenated blood away from the heart. Arteries are thicker in diameter compared to arterioles.

Veins and Venules: They return de-oxygenated blood back to the heart.

Capillaries: They are the smallest blood vessels in the body. They allow diffusion between the blood and cells to occur. The blood contains nutrients and oxygen, which diffuses through the capillary walls when the tissues need it. Carbon dioxide and waste products re-enter the capillary. Here they are processed and removed from the body.

Unit 3.5: Biomechanics (Basics)

Unit Objective

At the end of this unit, the participant will be able to:

1. State the different terms used in biomechanics
2. Define the term `force'
3. Define the term `torque'
4. Explain what are `levers' in human body

3.5.1 Biomechanical Terms

The study of the living body with reference to the force exerted by the muscles and gravity on the skeletal structure is called biomechanics. Let us look at the principles of biomechanics. These will help us to analyse common activities of daily living. We will also be able to understand the special movements that are used during a class in a gym.

Biomechanical Terms	
Lever	This is a hard bar with a fixed point. It rotates around this fixed point when external force is applied. Example: Bone
Axis of rotation (A) or Fulcrum	This is an imaginary line around which a lever rotates. It intersects the joint and is perpendicular to the plane movement. Example: Joint
Torque	When a force acts on a lever at some distance a turning/pivoting effect occurs, this is called a torque.
Effort Force (F) or Motive Force	This force causes the lever to move (usually a muscle) by increasing speed or changing direction.
Resistance (R)	This is the load that must be overcome for motion to occur (includes the weight of the body part being moved or the pull of gravity on that body part or an external weight).
Force Arm (FA)	The distance between the force and the axis.
Resistance Arm (RA)	The distance between the resistance and the axis/fulcrum.
Momentum	This can be defined as “mass in motion”. All objects have mass, so if an object is moving then it is said to be in momentum.
Force	This is the push and pull action that one object exerts on another.

3.5.2 Force

Force can be a push or a pull that creates compression, or a pull that creates tension. For a force to be created, one object must act on another. A movement occurs when one side pushes or pulls harder than the other side.

So we can say that:

- Force is any action or influence that moves an object
- Force can "control" movement of the body
- Force can be internal or external

Internal Force	External Force
Example: • Muscle contraction • Ligamentous restraint • Bony support	Example: • Gravity • Weight • Friction

3.5.3 Torque

Torque is the ability of force to produce rotation around an axis. Therefore, torque can be thought of as a rotary force. The lever will not rotate if the torque is equal and opposite. The lever will rotate in the direction of the greater torque if they are unequal. The interaction between internal and external forces ultimately controls our movements. These forces interact with through a system of bony levers, with the pivot point located at the axis of the rotation of our joints. With the help of these levers the internal and external forces are converted to internal and external torques. These ultimately cause movement or rotation of our joints.

3.5.4 Levers

Levers can help in customizing exercises to enhance a person's effort. If a person finds an exercise difficult or wants to make it more challenging, then the intensity of the exercise can be adjusted by changing the lever.

To find out about levers, let us consider the joint as the fulcrum/axis and bones as lever arms that move around the fulcrum. Muscle contraction is the force/effort applied to the lever (at the insertion point where the tendon attaches to the bone). The weight of the body part and any other external weight being lifted is considered resistance to the force.

Notes

Unit 3.6: Concept of Physical Fitness

Unit Objective

At the end of this unit, the participant will be able to:

1. State the factors that are a part of fitness
2. State the principles of exercise
3. Examine the FITT factors
4. Calculate the training heart rate (THR) of a person
5. Classify the various stages of fitness conditioning

3.6.1 Factors of Fitness

Definition of Fitness: According to Oxford dictionary, fitness is the condition of being fit and healthy and the ability to fulfil a particular role or task.

The ten factors that are a part of being fit are:

Fig 3.6.1 Fitness factors

How lean and thin a person is depends on his/her body composition and weight. Muscular tissue takes up less space in our body than fat tissue so two people of the same height and same body weight may look completely different from each other if their body composition is different.

The other five factors i.e. speed, agility, muscle power, balance and coordination are grouped together and form "motor" fitness. Training helps in developing endurance, stamina, speed and flexibility. Practice develops agility, balance and accuracy. Power and speed, both come with training and practice.

Cardiovascular Endurance	Muscle Endurance	Muscle Stength
• What it does - Capacity of the heart to deliver blood to working muscles and their capacity to use it successfully • Example: Long distance running , Marathons	• What it does- Capacity of a muscle or a muscle group to achieve prolonged movements and a capacity to work continously • Example: Cycling, Rowing, Kayaking	• What it does - Capacity of a muscle or a muscle group to exert a great amount of force in a single effort against resistance • Example: Weight lifting, Boxing

Strength Endurance	Flexibility	Power
• What it does - Capacity of the muscle to perform maximum contraction again and again • Example: Rebounding during a basketball game	• What it does - Capacity to move joints or group of joints over a complete range of motions without being blocked by fat or muscle • Example: Gymnastics, Leg splits	• What it does - Capacity to expend maximmum contraction at once with a forceful movement • Example: Sprint start, Jumping

Agility	Balance	Co-ordination	Body Composition
• What it does - Capacity to execute forceful movements in swift succession in opposite directions • Example: Zigzag running, Skeing game	• What it does - Capacity control the body in a position while the body is moving or stationary • Example: Handstand, gymnastics	• What it does - Capacity to combine all the other fitness components to achieve effective movements	• What it does - • Specifies the percentage of bone, fat and muscle in human bodies. • Percentage of fat is crucial because it helps in judging health and body weight of a person

3.6.2 Principles of Exercise

The principles of exercise are nothing but a set of guidelines that people need to follow to obtain optimum levels of fitness. These principles are applicable to all those people who want to be fit, whether he/she is an athlete, defence personnel or a regular walker or jogger.

The basic principles of exercise are:

Principles	What They Mean?
Regularity	A person has to develop a regular exercise routine, just as they have a time to eat, sleep and work.
Individuality	People are different and so their exercise needs are also different.
Trainability	As people are different, so will their response to training. Training exercise schedules will have to create to suit client's ability and their response to a given stimulus.
Balance	An effective fitness regime should cover all fitness factors. Highlighting only one part may lead to injury to others.
Progression	Once a person starts exercising and gets better with it then newer exercises have to be adapted.
Overload	This is part of progression; a person will do better with a little more. Therefore, the exercise session should exceed the regular demands of training.
Variety	Doing the same, exercise daily can be boring. A mixed assortment of exercises will help motivate people.
Specificity	Exercise regime must be planned with an aim or a goal.
Recovery	Difficult and hard training days must be alternated with easier exercise days. This will help in recovery of the muscles. This is especially important for strength and endurance training.

3.6.3 FITT Factors

The acronym FITT is used to describe factors that should be a part of every exercise routine. These factors are:

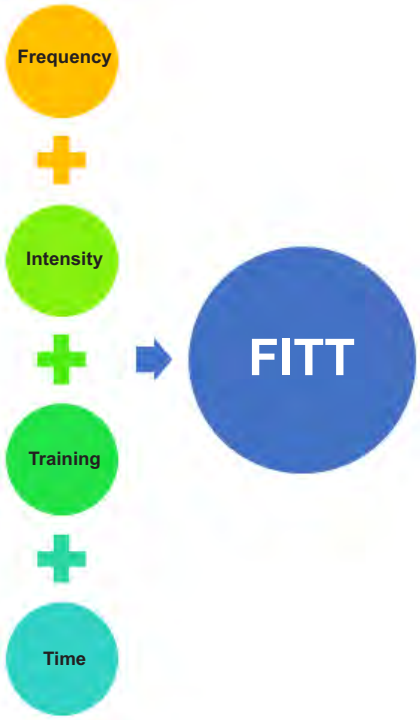


Fig 3.6.3 FITT factors

3.6.3.1 Frequency

Frequency = Intensity of Exercise + Duration of Exercise

With a little planning a good training program can be developed for a person of average fitness. This program should include all the factors of physical fitness. Ideally the best way to condition the cardio respiratory system is three workouts per week. Gradually these sessions can be increased to five times in a week for better benefits.

Ideal Time – Table for Frequency of Exercise

Example 1: Alternate Day Approach

	Week 1	
Days	**Type of Exercise**	**Supporting Exercises**
Monday	CR Fitness	Stretching
Tuesday	Muscle Endurance & Strength	Stretching
Wednesday	CR Fitness	Stretching
Thursday	Muscle Endurance & Strength	Stretching
Friday	CR Fitness	Stretching
	Week 2	
Monday	Muscle Endurance & Strength	Stretching
Tuesday	CR Fitness	Stretching
Wednesday	Muscle Endurance & Strength	Stretching
Thursday	CR Fitness	Stretching
Friday	Muscle Endurance & Strength	Stretching

Example 2: Hard Day/ Recovery Day Approach

	Week 1	
Days	**Type of Exercise**	**Supporting Exercises**
Monday	Hard Running	Stretching
Tuesday	Light Running	Stretching
Wednesday	Hard Running	Stretching
Thursday	Light Running	Stretching
Friday	Hard Running	Stretching

Things to follow while keeping the frequency of exercise in mind:

- Make sure that there is enough recovery time allotted between each exercise routine.
- Stretching exercises should be done during every session to increase flexibility.
- Do not over train as this will lead to injuries once the intensity and duration of training increases.

3.6.3.2 Intensity

Intensity of the exercise is one of the most important factors in attaining your exercise goal. Intensity of exercise is directly related to how hard one exercises. It represents the degree of effort one puts in to train.

3.6.3.3 Training

Training Heart Rate (THR):

THR is the range that defines the upper and lower limit of training intensity. People who exercise should base the intensity of their workouts for CR fitness by determining and exercising at their THR. This training will help people to perform CR exercise at the correct level of intensity.

THR rate can be determined by three readings of the heart:

- Maximum heart rate
- Resting heart rate
- Relative conditioning level

One can check the intensity of the exercise by tracking the heart rate of the person who is training. The person's level of exertion can thus be mapped and his/her fitness level improved. There are two methods to measure the heart rates:

- Percent Maximum Heart Rate (% MHR) and
- Percent Heart Rate Reserve (%HRR)

Method 1: Percent MHR Method

The THR is determined by using the estimated maximum heart rate.

The estimated maximum heart rate of a person can be determined by subtracting his age from 220.

For example, the heart rate of a 30-year-old man would have an estimated maximum heart rate (MHR) of 190 beats per minute (220 - 30 = 190).

The following benchmark is used during exercise:

Health	Percentage of MHR for Exercise
Poor shape	70% of his/her MHR
Relatively good shape	80% of his/her MHR
Excellent shape	90% of his /her MHR

Formula to calculate THR

To calculate THR of a person, multiply 0.80 times the MHR = BPM

% × MHR = THR

Example: Calculate the THR that is 80% of the estimated MHR for a 30-year-old man in good physical condition.

Calculation: **0.80 x 190 BPM = 152 BPM**

Method 2: Percent HRR (Heart Rate Reserve) Method

The percent HRR method is the most factual and exact method to calculate THR. A range of 60 to 90 90 percent HRR is the THR range in which people should exercise. This range is ideal to improve their CR fitness levels. The knowledge of his/her general level of CR fitness will help a person determine which percentage of HRR is a good starting point for him/her.

The following benchmark is used during exercise:

Health	Percentage of MHR for Exercise
Poor shape	60% of his/her MHR
Relatively good shape	70% of his/her MHR
Excellent shape	85% of his /her MHR

To maintain an adequate level of fitness CR workouts should be conducted with the heart rate between 70 to 75 percent HRR. If people do not have more than 20 minutes of exercise time for CR exercise, then they can reach a higher level of fitness from working at a higher percentage of HRR. The heart, muscles, and lungs will not receive an adequate training stimulus if a person exercises at any lower percentage of HRR than given. People should know their THR before starting aerobic training programs.

Example: Given below are the details of a 20-year-old male in reasonably good physical shape. Let us look at how to calculate the THR by using the resting heart rate reserve (HRR).

Step 1: Calculate the MHR by subtracting the person's age from 220.

Formula: 220 - age = MHR (Given)

Calculation: 220 - 20 = 200 BPM

Step 2: Calculate the RHR (Resting Heart Rate) in beats per minute (BPM) by counting the resting pulse for 30 seconds, and multiply the count by two. You can reduce the period but a 30-second count is more accurate. The RHR count should be taken while the person is completely relaxed and rested.

Now calculate the heart rate reserve (HRR) by subtracting the RHR from the estimated MHR. If the person's RHR is 69 BPM, the HRR is calculated as shown below:

Formula: MHR - RHR = HRR (Maximum Heart Rate - Resting Heart rate = Heart Rate Reserve)

Calculation: 200 BPM - 69 BPM = 131 BPM

Step 3: Calculate the THR based on 70 percent of HRR (a percentage based on a good level of CR fitness).

Formula: (% × HRR) + RHR = THR

(60-90% x Heart rate Reserve) + Resting Heart Rate = Training Heart Rate

Calculation: (0.70 × 131 BPM) + 69 BPM = 160.7 BPM

As per the above example, 70 percent is converted to the decimal form (0.70) before it is multiplied by the HRR.

The result is then added to the resting heart rate (RHR) to get the THR. Therefore, the product obtained by multiplying 0.70 and 131 is 91.7

When 91.7 is added to the RHR of 69, the outcome is a THR of 160.7

In the above example the calculations produce a fraction of a heartbeat, so, the value is rounded off to the nearest whole number. In this case, 160.7 BPM is rounded off to give a THR of 161 BPM.

To conclude, a reasonably fit 20-year-old with a resting heart rate of 69 BPM has a training heart rate goal of 161 BPM.

Tips to determine RHR or THR during and after exercise:

- Place the tip of the third finger lightly over one of the carotid arteries in the neck. These arteries are located to the left and right of the Adam's apple
- Monitor the pulse on the wrist of radial artery just above the base of the thumb
- Place the hand over the heart and count the number of heart beats

How to determine if the training intensity is enough?

During aerobic exercise, a person's body will reach a "Steady State" after five minutes and the heart rate will be levelled off. The trainer should:

- Monitor the person's heart rate at this time and immediately after exercising.
- Count his pulse for 10 seconds, then multiply this by six to get his heart rate for one minute. (This will let him determine if his training intensity is high enough to improve his CR fitness level)

Example: Let us take the THR of 161 BPM figured above. The trainer should get a count of 27 beats (161/6= 26.83 or 27) during the 10-second period. If the person is exercising at the right intensity then the trainer will get a count of 27 beats. If the persons pulse rate is below the THR, he must exercise harder to increase his pulse to the THR. If his pulse is above the THR, the person should exercise at a lower intensity to reduce the pulse rate to the prescribed THR.

Important Tip: Trainer should count the beats as accurately as possible, since one missed beat during the 10-second count, multiplied by six, will give an error of six BPM. If the person is able to maintain his/her THR throughout a 20 to 30 minute exercise period, then he is doing well and one can expect improvement in his/her fitness level. The trainer should check his exercise and post-exercise pulse rate at least once for each workout. If only one pulse check is taken, then it should be within five minutes into the workout.

Right Intensity: Training at the right intensity sometimes can be an issue and act as an obstacle in most exercise programs. It is important that the intensity should vary with the type of exercise that is performed.

For CR Development: The exercise performed for should be demanding enough to elevate the heart rate to between 60 and 90 percent of the heart rate reserve (HRR). People with low fitness levels should exercise at a lower training heart rate (THR) of about 60 percent of HRR.

For Muscular Strength and Endurance: The intensity relates to the percentage of the maximum resistance that is used for a given exercise. To determine intensity in a strength-training program, it is simpler to refer to a “Repetition Maximum or RM.” For example, 10-RM is the maximum weight that can be correctly lifted 10 times. 8-12 RM is the weight that should be lifted 8 to 12 times correctly. Doing an exercise "correctly" means moving the weight without wavering and with proper form. This should be done without getting help from other muscle groups by jerking, bending, or twisting the body. 8-12 RM is best for a regular person who wants to improve both muscular strength and endurance.

If a person “**A**” wants to concentrate on muscular strength he should use weights which allow him to do three to seven repetitions before his muscles get tired. Therefore, 3-7 RM is the ideal weight for strength development.

Now if person “**B**” wants to concentrate on muscular endurance he should use a 12+ RM. While applying 12+ RM as the intensity of training, the more repetitions performed per set, over time, the greater will be the improvement in muscular endurance.

Now if person “**C**” regularly trains with a weight which lets him do 100 repetitions per exercise (a 100-RM). This will greatly increase his muscular endurance but there will be a marginal improvement in his muscular strength. The greater the number of repetitions performed, the smaller will be the gains in strength. This is the exact opposite of what happens with person ``**B**''.

TIP: *All exercise sessions should include stretching during the warm-up and cool-down. While stretching a person may experience slight discomfort, but no pain, when the movement is taken beyond the normal range of motion and held for a few seconds.*

3.6.3.4 Time

Time, or duration, indicates the length of one exercise. It is the reverse in relation to intensity. The more intense the activity, the shorter the time needed to produce or maintain a training effect; the less intense the activity, the longer the required duration.

For CR Development: For a person to improve CR fitness, he/she must train for at least 20 to 30 minutes at his/her THR.

The time spent exercising depends on the type of exercise being done. At least 20 to 30 continuous minutes of intense exercise must be in order to improve cardio respiratory endurance.

For muscular endurance and strength, exercise: For this kind of exercise the time is equal to the number of repetitions done. In most people, 8 to 12 repetitions with enough resistance to cause muscle failure improves both muscular endurance and strength. As people progress with exercise, they will gain strength by doing two or three sets of each resistance exercise.

Depending on the objective of the session, flexibility exercises or stretches should be held for different times. 10-15 stretches should be held as a warming up exercise before a run. To cool down the body and to improve flexibility, it is best to do stretching, with each stretch held for 30 to 60 seconds. If improving flexibility is a major goal, then a minimum of one-two sessions per week should be devoted to developing it.

Type

The meaning of type here is the kind of exercise performed. One should always consider the principle of specificity while choosing the type of exercise. For example, to improve one's level of CR one should do CR types of exercises.

The primary rule is that to enhance performance, one must practice the particular exercise, activity, or skill that needs enhancement. For example, to be good at squats, one must do squats. No other exercise will improve squat performance as effectively.

FITT Factors Applied to Physical Conditioning Program

	Cardio-respiratory Endurance	Muscular Strength	Muscular Endurance	Muscular Strength and Muscular Endurance	Flexibility
Frequency	3 - 5 times per week	3 times per week	3 - 5 times per week	3 times per week	Warm up and cool down: Stretch before and after each exercise session Stretching: Stretch 2-3 times/week
Intensity	50 - 90% HRR*	3 - 7 RM*	12+ RM	8 - 12 RM	Tension and slight discomfort, NOT PAIN.
Time	20-30 minutes	3 - 7 repetitions of each exercise	12+ repetitions of each exercise	8 - 12 repetitions of each exercise	Warm up and cool down stretches: 10 - 15 seconds per stretch Developmental Stretching: 20 - 40 seconds per stretch

Type	Running Swimming Cross Country Skiing Rowing Bicycling Jumping Rope Walking Hiking	Free Weights Resistance Machines Body-Weight Exercises (Push-ups/Sit-ups/Pull-ups/Dips, etc.)	Stretching: Static Passive P.N.F.
*HRR - Heart Rate Reserve *RM - Repetition Maximum			

3.6.4 Phases of Fitness Conditioning

The training program for physical fitness is divided into three phases:

- **Preparatory**
- **Conditioning**
- **Maintenance**

Every individual is unique, so the initial phase for each individual varies depending on their age, fitness levels, and earlier physical activity.

People who are young and healthy will be able to begin exercising with the conditioning phase. Similarly, those who have been exercising regularly will already be in the maintenance phase. Other factors like illness or inconsistency in one's exercise program can cause individuals to drop from maintenance to a conditioning phase. Individuals in the age of 40 and above should start with the preparatory phase if they have not been active.

3.6.4.1 Preparatory Phase:

This is the phase where the cardio respiratory and muscular systems have to get used to exercise. This phase helps in preparing the body to handle the conditioning phase.

Initially the work load should be moderate. A gradual, planned increase in exercise should be performed in tandem with frequency, intensity and time. This means that the exercise should progress from a lower to a higher level of fitness.

Cardio- respiratory development: To start with, individuals who are in a poor condition should run or walk. This can be done three times a week at a comfortable pace that will elevates their heart rate to about 60 percent HRR for 10 to 15 minutes. Training should progress slowly and steadily. The days for rest and recovery should be evenly distributed throughout the week.

This kind of light exercise should be done by people until they have no undue fatigue or muscle soreness the day following the exercise. Their exercises should then be increased to 16 to 20 minutes and/or elevate their heart rate to about 70 percent HRR by increasing their pace. To understand that their pace is faster, they should run a known distance and try to cover it in less time.

Those people who feel breathless or their heart rate rises beyond the training heart rate (THR) while running should resume walking until the heart rate returns to the correct training level. These people will be ready for the next phase once they can handle an intensity of 70 percent HRR for 20 to 25 minutes.

Muscular endurance and strength: The preparatory phase for this type of exercise is through weight training. This should also start easily and progress gradually. In the beginning weight trainers should select about 8 to 12 exercises that work out all the body's major muscle groups. The weight training should be performed only with very light weights in the first week. This is essential, as people must first learn the proper mode for each exercise. The light weights will help in minimizing muscle soreness and will decrease the likelihood of injury to the muscles, joints, and ligaments.

During the second week, people should be introduced to heavier weights on each resistance exercise. By the end of the second week, people should know how much weight will let them do 8 to 12 repetitions to muscle failure for each exercise. This is the start of the conditioning phase.

3.6.4.2 Conditioning Phase

Once the strength and /or the endurance level of a person increases and they reach the desired level of fitness, he/she must increase their amount of exercise correspondingly.

CR Development: To improve cardio respiratory endurance, people should increase the length of time they run. They should graduate from the preparatory phase by increasing the running time by one or two minutes each week until they can run continuously for 20 to 30 minutes. They should train for a minimum of three times a week and a break of maximum of two days between workouts.

Muscular endurance and strength: For weight training, the conditioning phase normally starts in the third week. They should do one set of 8 to 12 repetitions for each of the selected resistance exercises. Once they are able to do more than 12 repetitions of any exercise, they should increase the weight by about five percent so they can again do only 8 to 12 repetitions. This process should continue all through the conditioning phase. It is not necessary for them to do more than one set per exercise as long as they continue to progress and get stronger while doing only one set of each exercise.

If after one set, there is no visible progression, and then another set can be added. This should be done only on those exercises in which the progress has slowed. Gradually as the training progresses, they may want to increase the sets to three to help build up strength and/or muscle mass.

To achieve maximum benefit, people who do weight training should do also do strength training three times a week with 48 hours of rest between workouts for any given muscle group. It helps to systematically do a different type of exercise for a given muscle or muscle group. This adds variety and ensures better strength development.

3.6.4.3 Maintenance Phase

This phase bolsters the high level of fitness achieved in the conditioning phase. In this phase, the emphasis is not on progression. A 45 to 60-minute workout (including warm-up and cool-down) at the right intensity three times a week is enough to maintain almost any appropriate level of physical fitness. These workouts should be devised well to produce maximum results. These workouts give people the time to stabilize their flexibility, CR endurance, muscular endurance and strength. People should not disregard the fact that more frequent training may be needed to reach and maintain peak fitness levels.

A well-prepared program uses an assortment of activities to develop muscular endurance and strength, CR endurance, and flexibility, and to achieve good body composition. It should also boost the development of coordination as well as basic physical skills.

Age as Factor in Physical Fitness

People undergo many physiological changes as they grow older. For example, the amount of blood the heart can pump per beat and per minute decreases during heavy exercise, as does the maximum heart rate. This lowers a person's physical ability, and performance during exercise suffers. Add to this, the decrease in total muscle mass and the increase in the percent of body weight, which is composed of fat. Because of this the muscular strength and endurance, CR endurance, and body composition suffer. A decrease in flexibility also occurs.

Men tend to maintain their peak levels of muscular strength and endurance and CR fitness until age 30. After 30 there is a slow and visible decline throughout their lives. Women reach their peak in physical capability shortly after puberty and then go through a systematic decline.

Although aging is a primary factor for the decline in performance but, those who stay physically active do not have the same rate of decline as those who do not. Those who train regularly show a lesser degree of decline in muscular strength and endurance, CR endurance, and flexibility.

People who are fit at age 40 and continue to exercise show a lesser decrease in many of the physiological functions related to fitness than do those who hardly exercise. A trained 60-year-old, for example, may have the same level of CR fitness as an inactive 20-year-old. To sum up, regular exercise can help add life to your years and years to your life.

Notes

Unit 3.7: Exercise Physiology

Unit Objectives

At the end of this unit, the participant will be able to:

1. Explain the different components that are a part of physical fitness
2. Demonstrate the different type of exercise for Cardio Respiratory Fitness, Muscular Strength and Endurance
3. Examine the principles and techniques of physical training

3.7.1 Components of Physical Fitness

Exercise is always planned and structured. It is done to improve the performance of our body parts like heart, lungs, joints and the muscles in our body. Exercise is the catalyst that creates important physiological changes in our body. For this, it is important to develop and execute an exercise routine that is safe, is effective and has a goal. Fitness is shaped by:

- Age
- Sex
- Heredity
- Personal habits
- Exercise Routine
- Eating habits

There are two components to a fitness program. They are primary and secondary components. Let us look at them in detail in the chart given below.

Fitness	
Primary Components	**Secondary Components**
Cardio Respiratory Fitness	Agility
Muscular Endurance	Balance
Muscular Strength	Coordination
Flexibility	Power
Body Composition	Reaction Time
	Speed

3.7.2 Cardio Respiratory Fitness

Primary and Secondary Aerobic exercises

The CR fitness of a person can improve only through exercises that require breathing in large volumes of air. These are called aerobic exercises. These activities must engage in the use of large muscle groups. They should also be rhythmic in nature, of sufficient duration and intensity (60 to 90 percent HRR). The primary and secondary exercises for improving CR fitness are as follows:

Primary Exercises

List of some of the primary exercises are:

- Running
- Rowing
- Jogging
- Skiing (cross-country)
- Walking
- Exercising to music
- Rope skipping
- Bicycling (stationary)
- Swimming
- Bicycling (road/street)
- Stair climbing

Secondary Exercises:

These exercises are done with partners or players of equal or greater skill. Some examples are:

- Racquetball (singles)
- Basketball (full court)
- Handball (singles)
- Tennis (singles)

Note: The primary exercises are more effective than the secondary exercises to bring forth positive changes in CR fitness. The secondary activities may elevate the heart rate for a short period but may not keep it elevated to the THR throughout the entire workout.

3.7.3 Principles and Techniques of Physical Training & Running

It prepares the body to enhance the transportation of blood and oxygen to the working muscles and brings about positive changes in the muscles' ability to produce energy.

Fig 3.8.3 (a) Running

It can be incorporated into any physical training program because a training effect can be attained with only three 20-minute workouts per week.

Recovery time between hard bouts of running is important as overtraining will cause major of injuries. A well-conditioned person can easily run five to six times a week. There are two things one needs to keep in mind while running:

1. Regularly and steadily build up to running that many times
2. Modify the intensity and/or duration of the running sessions to allow recovery between them

3.8.3.2 Interval Training

Fig 3.8.3 (b) Interval Training

Interval training works on the cardio respiratory system. This is an advanced form of exercise training where a person's fitness levels can improve significantly in a relatively short time. This can also increase his/her running speed.

In this type of training, a person runs at a pace that is marginally faster than his/her race pace for brief period of time. The person has to do this repeatedly with periods of recovery placed between periods of fast running. The energy used is allowed to recover. This way the person can run at a faster pace than if he ran continuously without resting. Interval training can also be used with activities such as cycling, swimming, bicycling, and rowing.

It is not important to monitor the heart-rate response during interval training. However, one has to make sure that the work intervals are run at the proper speed.

Once the person becomes more conditioned to running, his recovery is quicker. Now, he/she should either shorten the recovery interval or run the interval a few seconds faster.

After the person has reached a good CR fitness level using the THR method, he should be ready for interval training. Interval training should be introduced gradually and progressively. In the beginning the interval training should be done once a week. If the person responds well, then it can be introduced for twice a week. This too should have at least one recovery day in between. Like any other workout, interval workouts should start and end with warm-ups and a cool-down session.

Alternate Forms of Aerobic Exercise

Not everyone can perform the same type of exercise. For example, not everyone can run. In such cases, other activities can be used as supplements or alternatives. Some good substitutes for running are swimming, bicycling, and cross-country skiing. Their only flaw is that they require special equipment and infrastructure that may not be available always.

3.8.3.3 Swimming

Fig 3.8.3 (c) Swimming

Swimming is used to improve a person's CR fitness level. It is also very helpful to maintain and improve CR fitness during recovery from an injury. Swimming can develop upper body endurance and limited strength. As a beginner, the swimmer should start slowly with a restful stroke. While swimming, he/she should stop after five minutes, to check his/her pulse. This should be compared to his/her THR and, if needed, then the intensity should be adjusted.

The THR is lower in swimming as compared with all the other modes of aerobic exercise. This is because, during swimming, the heart does not beat as fast as when doing the other types of exercise at the same work rate. So, if a person wants to effectively train the CR system during swimming, then he/she should set his/her THR to about 10 bpm lower than while running. For example, if a person's THR is 150 while running then his THR should be about 140 bpm while swimming. This modification in THR will help the person to swim at proper intensity.

People who do not know how to swim can run in waist-to chest-deep water, tread water, and do poolside kicking for a great aerobic workout. They can also perform calisthenics in the water. Together these activities combine walking and running with moderate resistance work for the upper body.

Advantages of swimming are:

- It involves all the major muscle groups
- The body position enhances the blood's return to the heart
- As the body is supported partially by water and this minimizes lower body stress in overweight people

3.8.3.4 Cycling

Fig 3.8.3 (d) Cycling

Cycling is good exercise for developing CR fitness. Cycling can be done outdoors or on a stationary cycling machine indoors. If a person is cycling on the road, then it should be intense enough to allow him/her to reach and maintain THR at least 30 minutes.

Cycling intensity and increase in velocity can be achieved by bikers by changing gears riding uphill. Bikers can also increase the distance, though is not as important as the amount of time spent training at THR. The intensity of a cycling workout can be increased by increasing the resistance against the wheel or expanding the pedalling cadence (number of RPM). If cycling is used for interval training, then one can vary the speed and resistance and use periods of active recovery at low speed and/or low resistance.

3.8.3.5 Walking

Fig 3.8.3 (e) Walking

Walking is another good exercise to develop cardio-respiratory fitness. It is enjoyable, requires no equipment, and causes few injuries. However, unless walking is done for a long time at the correct intensity, it will not produce any significant CR conditioning.

People with a low degree of fitness should begin slowly with 12 minutes of walking at a comfortable pace. The heart rate should be monitored to determine the intensity. A person should walk at least four times a week and add two minutes each week to every walking session until the duration reaches 45 to 60 minutes per walk. The intensity of the walk can be increased by adding hills or stairs.

Once the walker's fitness rises, he/she should walk 45 to 60 minutes at a faster pace. An effortless way to increase walking speed is to position the arms in a similar fashion like in running. This technique will help the walker to get a shorter arm swing and take steps at a faster rate. Power walking is a modified form of race walking where arms are swung faster to increase the pace. This allows for more upper-body work.

If a walker continues this exercise regularly for about three months, He/she will reach a level of conditioning that lets them move into a running program.

Guidelines for Walking:

Posture

- Step 1: Stand up straight.
- Step 2: Stretch your body upward.
- Step 3: Look straight, at least 20 feet ahead.
- Step 4: Keep the chin up (parallel to the ground). This will reduce strain on neck and back.
- Step 5: Move your shoulders back slightly. Let your shoulders fall and relax.
- Step 6: Suck in your stomach
- Step 7: Tuck in your behind - rotate your hip forward slightly. This will keep you from arching your back.

Don'ts:

- Do not arch your back.
- Do not lean forward or lean back. Leaning puts strain on the back muscles.
- Do not look down

Arms

- Step 1: Bend your elbow at 90 degrees.
- Step 2: Keep your hands loose in a partially closed curl.
- Step 3: With every step, move the arm opposite your forward foot straight, not diagonal.
- Step 4: As the foot goes back, the opposite arm comes straight back.
- Step 5: Keep your elbows close to your body.
- Step 6: Make sure your forward hand does not cross the centre point of your body.
- Step 7: Keep the hand low, no higher than your breastbone when coming forward.

Don'ts:

- Do not clench your hands while walking. This can raise your blood pressure and should be avoided.
- Do not "chicken wing" your elbows.
- Do not pump your arms up high in the air, this will not help propel you.

TIP: *If you find the arm motion tiring, then initially do it for 5 to 10 minutes at a time and then let your arms rest.*

Taking a Step

- Step 1: Strike the ground first with your heel.
- Step 2: Roll through the step from heel to toe.
- Step 3: Push off with your toe.
- Step 4: Bring the back leg forward to strike again with the heel.

TIP: *Make sure you wear good flexible shoes. This will ensure you are able to roll through the step.*

The Stride

- Step 1: Take smaller steps rather than lengthening your stride.
- Step 2: Your stride should be longer behind your body, where your toe is pushing off, rather than out in front of your body.

TIP: *Your back leg is what is driving you forward. Your forward leg has no power. The key to powerful, efficient walking is getting the full power out of the push from the back leg as it rolls from heel to toe is the key to powerful, efficient walking. Fast walkers train themselves to increase the number of steps they take per second and to get full use out of the back part of the stride.*

Warm Up
Time Required: 5 minutes

- Step 1: Begin slowly with an easy pace for each walking session.
- Step 2: Add speed or hills to allow your muscles to warm up before you stretch.

Stretching
Time Required: 5 minutes

You will be able to walk more comfortably as stretching will add flexibility. You will be able to walk at your desired speed after stretching.

Don'ts:

- Never stretch cold muscles or you risk tearing them.

Cool Down
Time Required: 5 -10 minutes

- Finish your walk with an easy walking pace.
- Repeat the stretches you did after your warm-up.
- Hold each stretch for a longer period of time.

3.8.3.6 Rope Skipping

This is also a good exercise for developing CR fitness. The only equipment needed for this exercise is a rope. Also, it can be done almost anywhere, and is not affected by weather. People who run can use it as a substitute for running during bad weather.

To start with, rope skippers should monitor their heart rate after five minutes of jumping rope. To ensure a good training effect, skippers should attain and maintain their THR. The time spent jumping should be increased as the fitness level improves.

Fig 3.8.3 (f) Rope Skipping

Selecting a Rope:

- Select a jump rope that, when doubled and stood on, reaches to the armpits.
- Weighted handles or ropes can be used to improve upper body strength.

Don'ts:

- Do not skip for more than 3 times a week. Rope jumping is stressful to the lower extremities
- Do not attempt rope jumping above the age of 40 years
- Do not skip rope on a hard surface. Always use a cushioned surface like a mat or a carpet. Always wear cushioned shoes.

3.8.3.7 Handball and Racquet Sports

Tennis, squash and racquetball are sports, which involve bursts of intense activity for short periods. They are good option and provide excellent aerobic benefits depending on the skill of the players. However, they do not provide the same degree of aerobic training as exercises of longer duration done at lower intensities. If these sports are pursued actively each day, they may be an adequate substitute for low-level aerobic training.

Fig 3.8.3 (g) Handball and Racquet Sports

Note: Running increases endurance and it helps improve performance in racket sports, however, the reverse is may not necessarily be true.

3.8.3.8 Exercise to Music

Another excellent alternative to running is aerobic exercise done to music. These exercises are motivating, challenging activities that are a combination of exercise and rhythmic movements. No mandatory skill is required, and it can be personalised depending on the person's fitness level by varying the frequency, intensity, and duration. Workouts can be done in a small space by different groups of varying fitness levels. This exercise involves moving to various beats of music while jogging, doing jumping jacks, hops, jumps, or other calisthenics. Including strengthening exercises and light dumbbells during workouts will increase intensity for the upper body and improve muscular endurance too.

Fig 3.8.3 (h) Exercise to Music

Note: To make sure that the workout is sufficiently intense, heart rates should be taken during the conditioning phase. Warm-up and cool-down stretches should be included in the aerobic workout.

Warm Up and Cool Down

Warm – Up: The human body needs to be conditioned before taking part in organized physical training programs, unit sports competition or vigorous physical activity. Warm-ups should be done for five to seven minutes and should happen just before the CR or muscular endurance and strength part of the workout.

Warm up exercises include:

- Running-in-place
- Slow jogging
- Stretching
- Calisthenics

Advantages of Warm-ups

- It helps prevent injuries the heart, muscles, ligaments, and tendons are properly prepared for exertion
- It maximizes performance.
- It increases the body's internal temperature and the heart rate.

Cool Down: Cooling down properly is essential after each exercise period, regardless of the type of workout. Cool down exercises should be done for 5 -7 minutes by walking and stretching until the heart rate is less than 100 beats per minute (BPM) and heavy sweating stops.

Cool Down exercises include:

- Walking
- Stretching

Advantages of Cool Down

- It serves to gradually slow the heart rate
- It helps the blood to return to the heart. Muscles are relaxed after exercise this prevents the blood flow to the heart. The blood can accumulate in the legs and feet and can cause a person to faint.

3.8.4 Muscular Strength and Endurance

Apart from cardio respiratory fitness, one needs a high level of muscular endurance and strength. Muscular strength and endurance is required to carry out strength related tasks like carrying an injured person, pushing stalled vehicles etc.

Muscular Fitness

Muscular fitness has two components:

- **Muscular strength:** It is the greatest amount of force a muscle or muscle group can exert in a single effort.
- **Muscular endurance:** It is the ability of a muscle or muscle group to do repeated contractions against a less-than-maximum resistance for a given time

Muscular strength and endurance are closely related even though they both are separate fitness components. By working progressively against resistance will produce gains in both of these components. The resistance training sometimes may result initially in small temporary weight gain due to increase in muscle mass, which may initially outpace fat loss.

Advantages of Muscular Fitness:

- It helps to maintain or build the Lean Body Mass and increase body's muscle
- It strengthens ligaments and tendons.
- It halts or reverses osteoarthritis and osteoporosis (especially in menopausal women), protects against Muscle loss (Sarcopenia) with age and burns more calories at rest.
- Anaerobic exercises (resistance exercises) utilize fat hours after exercise.
- It restores muscle tissue that had been lost over the years from a sedentary modern lifestyle
- It rises the metabolism level hours after exercise. The resting metabolic rate increases and therefore daily calorie expenditure, which aids weight management
- It reduces the risk of bone fractures especially amongst elderly people.
- It improves and corrects posture by correcting muscular imbalances. For e.g. Weak abdominal muscles, strong hip flexors etc.
- It increases joint mobility as the joint is worked through the full range of motion through isotonic or dynamic exercise.
- It reduces insulin insensitivity thereby reducing the medication of diabetes type 2 individuals.
- It helps asthmatics and people suffering from COAD (chronic obstructive airways disease) especially those on steroids, as these tend to reduce bone mass.

Muscular Contractions:

These muscular endurance and strength exercise are best produced by regularly doing each specific kind of contraction. There are three types of contractions

Isometric: It produces contraction but no movement. Example: Pushing against a wall.

Isotonic: It produces force with no change in the angle of the joint and no change in length of muscle.

Isokinetic: It causes a joint to move through a range of motion against a constant resistance. Example: Push-ups, sit-ups, lifting of weights, etc.

These contractions cause the angle at the joint to change at a constant rate, for example, at 180 degrees per second. To attain a consistent speed of movement, the load or resistance must change at different joint angles to reverse the varying forces produced by the muscle(s) at different angles. This requires the use of isokinetic machines.

These resistance-training machines control the speed of movement by varying the resistance throughout the range of motion. Some of these devices are classified as pseudo-isokinetic and some as variable-resistance machines.

Two Phases of Isotonic and Isokinetic Contractions are:

Concentric or "Positive" Phase	Eccentric or "Negative" Phase
Shortening – Contraction of Muscles	Elongation – muscle returns to its normal length
Example: During the upward phase of bicep curl, the muscles are shortening	Example: During the lowering phase of the curl, the biceps are lengthening
Muscle can control more weight in this phase	May not be able to control weight
Muscles can handle overload	
Produces greater strength gains	
Note: The muscle and connective tissue more susceptible to damage, so there is more muscle soreness following eccentric work.	

TIP: *A properly designed weight training program with free weights or resistance machines will result in improvements in all three contractions.*

Principles of Muscular Training

The seven principles of exercise must be applied to all muscular endurance and strength training. These principles are overload, progression, specificity, regularity, recovery, balance, and variety.

Overload

Overload is the basis for all exercise training programs. For a muscle to gain strength, the workload to which it is subjected during exercise must be increased beyond what it ordinary experience. This means that the muscle must be overloaded. Muscles react to increased workloads by becoming larger and stronger and by developing greater endurance.

Following are the strength-training terms used for overload:

- **Full range of motion:** To obtain maximum gains, the overload must be applied throughout the full range of motion. During exercise, a joint and its associated muscles should go through its complete range starting from the pre-stretched position (stretched past the relaxed position) and ending in a fully contracted position. This is important for strength development.
- **Repetition:** We can say that one repetition has been completed when an exercise has progressed through one complete range of motion and comes back to the beginning.
- **One-repetition maximum (1-RM):** This is a repetition performed against the greatest possible resistance (the maximum weight a person can lift one time). This means that 10-RM is the maximum weight a person can lift correctly 10 times. Likewise, an 8-12 RM is the weight which allows a person to do 8 to 12 correct repetitions. The intensity for muscular endurance and strength training is often expressed as a percentage of the 1-RM.
- **Set:** This is a series of repetitions done without any rest in between.
- **Muscle Failure:** This happens when a person is unable to do another correct repetition in a set.

The minimum resistance a person needs to gain strength gains is 50 percent of the 1-RM. To achieve enough overload, programs are designed to require sets with 70 to 80 percent of one's 1-RM. (For example, if a person's 1-RM is 200 pounds, multiply 200 pounds by 70 percent [200 × 0.70 = 140 pounds] to get 70 percent of the 1-RM.)

The repetition maximum (RM) method is a better and easier method. In this method, the person finds and uses that weight which lets him do the correct number of repetitions. For example, to develop both muscle endurance and strength, a person should choose a weight for each exercise, which lets him/her do 8 to 12 repetitions to muscle failure. The weight should be heavy enough so that, after doing from 8 to 12 repetitions, he/she should not be able do another repetition. This weight is the 8-12 RM for that exercise.

FITT Factors for Muscular Endurance and/or Strength			
	Muscular Strength	**Muscular Endurance**	**Muscular Strength and Muscular Endurance**
Frequency	3 times per week	3 - 5 times per week	3 times per week
Intensity	3 - 7 RM*	12+ RM	8 - 12 RM
Time	3 - 7 repetitions of each resistance exercise	12+ repetitions of each resistance exercise	8 - 12 repetitions of each resistance exercise
Type	Free Weights Resistance Machines Body-Weight Exercises (Push-ups/Sit-ups/Pull-ups/Dips, etc.)		
*RM - Repetition Maximum			

How to Develop Muscular Endurance / Strength

Tips to develop muscle strength:

Weight Selection: The weight selected should be heavier and the RM should also be different. For example, the person should find that weight for each exercise which lets him do 3 to 7 repetitions correctly. This weight is the 3-7 RM for that exercise.

Ideal Range: The greatest improvements come from resistance of about 6-RM; however an effective range is a 3-7 RM. The weight should be such that an eighth repetition would be impossible because of muscle fatigue.

Correct RM: To advance muscular endurance, the person should choose a resistance that lets him/her do more than 12 repetitions of a given exercise. This is his/her 12+ repetition maximum (12+ RM). With continuous training, the more the number of repetitions per set, the greater will be the improvement in muscle endurance and lesser the gains in strength. For example, when a weight lifter trains with a 25-RM weight, his gain in muscular endurance will be greater than when using a 15-RM weight, but the gain in strength will not be as great.

Whichever RM range is selected, the person must always strive to over-load his muscles. The fundamental principle to overloading a muscle is to make that muscle exercise harder than it normally does.

Note: The weight should never be too heavy. If a person cannot do at least three repetitions of an exercise, it means that the resistance is too great and should be reduced. People who are just beginning a resistance-training program should not start with heavy weights. They should first build an adequate ground by training with an 8-12 RM or a 12+ RM.

How to achieve overload?

- By increasing the resistance
- By increasing the number of repetitions per set
- By increasing the number of sets
- By reducing the rest time between sets
- By increasing the speed of movement in the concentric phase. (Good form is more important than the speed of movement.)

Progression

In a well-planned training program, significant increases in strength can be made in three to four weeks depending on the person. The workload has to increase progressively to keep pace with newly won strength; otherwise there will be no further gains. When a person can correctly lift the upper limit of repetitions for the set without reaching muscle failure, it is time to increase the resistance. For most people, this upper limit is 12 repetitions.

For example, if a person wants to do 12 repetitions in the bench press, the person should start with a weight that causes muscle failure between 8 and 12 repetitions (8-12 RM). He/She should then continue with that weight until he/she can do 12 repetitions correctly. Then the weight should be increased by about 5 percent but no more than 10 percent.

In a multi-set routine, if the goal is to do three sets of eight repetitions of an exercise, the person should start with a weight that causes muscle failure before he completes the eighth repetition in one or more of the sets. He/she should continue to work with that weight until he/she can complete all eight repetitions in each set. The resistance should be increased by 10 percent only when this is achieved.

Specificity

A resistance-training program is designed to provide resistance to the specific muscle groups that need to be strengthened.

A simple assessment can be done to identify these groups:

- Slowly do work-related movements for the muscles that need improvement
- Feel the muscles on each side of the joints where the motion occurs. The muscles that are contracting or becoming tense during the movement are the muscle groups involved.

Regularity

A person can maintain a balance and moderate level of strength by doing proper strength workouts only once a week, however three workouts per week are best for optimal results. The principle of regularity also applies to the exercises for individual muscle groups. For example, if a person works out three times a week, but different muscle groups are exercised at each workout, the principle of regularity is violated and gains in strength are minimal.

Note: Exercise must be done regularly to produce a training effect. Irregular and infrequent exercise may do more harm than good.

Recovery

Continuously training with the same muscle group everyday can be harmful. The muscles must be given enough recovery time to adapt. The best way to do strength training every day is by rotating the muscle groups. A minimum gap of 48-hours recovery period should occur between workouts for the same muscle groups. For example, the upper body muscles can be trained with weights on Monday, Wednesday, and Friday and the leg muscles on Tuesday, Thursday, and Saturday.

Recovery time in between the exercises is also important. This recovery time between different exercises and sets depends on the intensity of the workout. The recovery time between sets should be 30 to 180 seconds.

Balance

It is important to include exercises that work all the major muscle groups in both the upper and lower body. Most muscles are organized into opposite pairs. When one muscle is activated, it results in a pulling motion, the opposing muscle results in the pushing, movement. A training session should be planned in such a way that a pushing exercise is followed by a pulling exercise. This results in movement of the same joints.

Example, follow an overhead press with a lat pull-down exercise. This approach helps ensure good strength balance between opposing muscle groups. This also helps in reducing risk of injury.

The larger muscle groups should be exercised first, then the smaller muscles. For example, the lat pull-down stresses both the larger latissimus dorsi muscle of the back and the smaller biceps muscles of the arm. Here, if curls are done first, the smaller muscle group will be exhausted and too weak to handle the resistance needed for the lat pull-down. As a result, the person will not be able to do as many repetitions with as much weight as he normally could in the lat pull-down. The latissimus dorsi muscles will not be overloaded and, so, they may not benefit very much from the workout.

The best sequence to follow for a total-body strength workout:

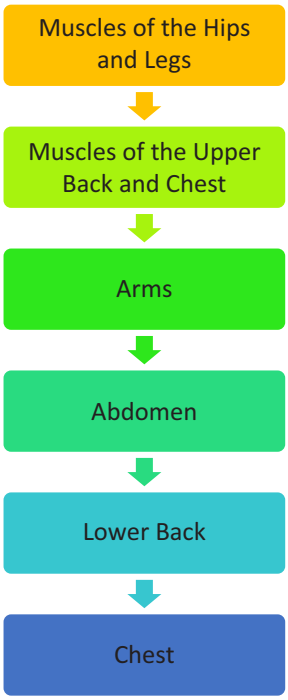


Fig 3.8.4 Sequence of total-body strength workout

Improvement in fitness will be visible as long as all muscle groups are exercised at the proper intensity.

Variety

A major problem area for all fitness training programs is sustaining enthusiasm and interest. A badly designed strength-training program can be very dull. Using a variety of different equipment, changing the exercises, and modifying the volume and intensity are good ways to add variation. This will definitely produce better results. The trainer should periodically replace different exercises for a given muscle group(s). For example, he can do squats with a barbell instead of leg presses on a weight machine.

Workout Techniques

Apart from the principles of fitness, there are also other factors to consider while working out. These are safety, exercise selection, and phases of conditioning.

Safety Factors

The main causes of injury when strength training are:

- Improper lifting techniques
- Lifting weights that are too heavy

Guidelines for Safe Exercise Routine:

The main causes of injury when strength training are:

- Understand how to do each lift correctly before starting the strength training program
- Lift weights with a training partner, or spotter, who can observe your performance as you exercise
- Understand how to use the equipment for safety and the best results Understand the proper spotting technique for each exercise
- Select weights so that proper form can be maintained for the appropriate number of repetitions
- Learn to breathe correctly. Make sure you breathe constantly. Never hold your breath while lifting weights as this can lead to dizziness.
- Learn to exhale during the positive (concentric) phase of contraction as the weight or weight stack moves away from the floor, and inhale during the negative (eccentric) phase as the weight returns toward the floor.

Exercise Selection

A person should choose 8- 16 exercises that workout the entire major muscles in the body. These exercises will serve as a good starting point. The person should choose exercises that work several muscle groups and try avoid those that isolate single muscle groups. This will help to train a larger number of muscles at a given time.

A simple way to select an exercise is to determine the number of joints in the body where movement occurs during a repetition. Beginners must select exercises that are "multi-joint" exercises. The exercise should provide movement at more than one joint.

Good Selection: The lat pull-downs on the "lat machine" work the latissimus dorsi of the back and the biceps muscles of the upper arm. This is a good exercise

Bad Selection: Concentration curls for the biceps muscles of the upper arm, although an effective exercise, only works the arm flexor muscles. Also, the concentration curl requires twice as much time as lat pull-downs because only one arm is worked at a time.

Good Selection: The pull-down exercise produces motion at both the shoulder and elbow joints.

Bad Selection: The concentration curl, only involves the elbow joint.

Timed Sets

Timed sets indicate a method of physical training in which as many repetitions as possible of a given exercise are performed in a specified period of time. After a convenient period of rest, a second, third, and so on, set of that exercise is done in an equal or lesser time period. The exercise period, recovery period, and the number of sets done should be chosen to make sure that an overload of the involved muscle groups occurs.

Notes

Unit 3.9: Types of Gym Exercises

Unit Objective

At the end of this unit, the participant will be able to:

- List the different types of gym exercises

3.9.1 Types of Gym Exercises

There are four main types of physical activity. Those are aerobic, muscle strengthening, bone strengthening and stretching. The different exercises related to these physical activities are mentioned below.

Name of Exercise	Description
Bench Press	Bench Press is an upper body strength training exercise that consists of pressing a weight upwards from a supine position. The exercise works the pectoralis major as well as supporting chest, arm, and shoulder muscles such as the anterior deltoids, serratus anterior, coracobrachialis, scapulae fixers, trapezii, and the triceps. A barbell is generally used to hold the weight, but a pair of dumbbells can also be used.
Lat Pulldown	Lat pulldown is a basic upper body strength exercise that targets the upper back. The exercise also improves stability in the lower back and core. Sit on a lat pulldown station and grab the bar with an overhand grip that's just beyond shoulder width.
Pull Up	Pull-up is an upper-body compound pulling exercise. A traditional pull-up relies on upper body strength with no swinging or "kipping" (using a forceful initial movement of the legs in order to gain momentum). The exercise mostly targets the latissimus dorsi muscle of the back along with other assisting muscles.

Push Up	Push-up (or Press-up) is a common exercise performed in a prone position by raising and lowering the body using the arms. Push-ups exercise the pectoral muscles, triceps, and anterior deltoids, with ancillary benefits to the rest of the deltoids, serratus anterior, coracobrachialis and the midsection as a whole.
Seated Row	Seated row is one of the most effective exercises for targeting your back muscles. The seated row is considered a general back exercise because it hits so many back muscles.
Standing Row	Standing row is a weight training exercise performed by holding a grips with the overhand grip and lifting it straight up to the collarbone. This is a compound exercise that involves the trapezius, the deltoids and the biceps.
Shoulder Press	While the shoulder press focuses primarily on two portions of the deltoids, or shoulders, it also works a plethora of other muscles. Your trapezius, triceps and rotary cuff muscles all have to work in conjunction with your shoulders for this exercise to be done.
Supine Bridge	Supine Bridge or Hip Thrust is an exercise that is performed lying on the back. It can be considered both and anti-flexion exercise (since you are working lumbar stability and hip extension) and a glute activation exercise.

Deadlift	Deadlift is a weight training exercise in which a loaded barbell or bar is lifted off the ground to the level of the hips, then lowered by controlled effort to the ground. It is one of the three powerlifting exercises, along with the squat and bench press.
Squat	In strength training and fitness, the squat is a compound, full body exercise that trains primarily the muscles of the thighs, hips and buttocks, quadriceps femoris muscle (vastus lateralis, vastus medialis, vastus intermedius and rectus femoris), hamstrings, as well as strengthening the bones, ligaments and insertion of the tendons throughout the lower body. Squats are considered as a vital exercise for increasing the strength and size of the legs and buttocks, as well as developing core strength.
Leg Press	Leg press is a weight training exercise in which the individual pushes a weight or resistance away from them using their legs. The term leg press also refers to the apparatus used to perform this exercise. Leg press can be used to evaluate an athlete's overall lower body strength (from knee joint to hip). It has the potential to inflict grave injury: the knees could bend the wrong way if they are locked during a leg press.
Lunge	Lunge can refer to any position of the human body where one leg is positioned forward with knee bent and foot flat on the ground while the other leg is positioned behind. It is used by athletes in cross-training for sports, by weight-trainers as a fitness exercise, and by yogis as part of an asana regimen.

Step-Up	Step-up is a simple body resistance exercise that works muscles in the legs and buttocks. A step-up targets the quadriceps, here, and hamstrings, here, as well as the gluteal muscles in the buttocks. This is a good general lower body conditioning exercise.
Leg Extension	Leg extension is a resistance weight training exercise that targets the quadriceps muscle in the legs. The exercise is done using a machine called the Leg Extension Machine. The leg extension is an isolated exercise targeting one specific muscle group, the quadriceps. It should not be considered as a total leg workout, such as the squat or deadlift.
Leg Curl	Leg curl, also known as the hamstring curl, is an isolation exercise that targets the hamstring muscles. The exercise involves flexing the lower leg against resistance towards the buttocks. Other exercises that can be used to strengthen the hamstrings are the glute-ham raise and the deadlift.
Abdominal Reverse Curl	Ab Reverse Curl is an abdominal exercise that strengthens the transverse abdominus, helping flatten your belly and strengthen your entire core.
Plank	Plank is one of the best exercises you can do for your core because it builds isometric strength to help sculpt your waistline and improve your posture. And depending on the type of plank you try, you can also engage your back, arms, shoulders, glutes, and hamstrings.

Side Bend	Side bends can be performed with weights to develop muscle strength or as a body weight exercise to develop spinal mobility. Whichever type of side bend you perform, it is important that you only lean sideways and do not allow your body to twist. Another important factor is to avoid bending too far. An excessive range of movement may place your spine in a potentially injurious position. Side bends involve numerous muscles.
Dumbbell Fly	Lie down on a flat bench with a dumbbell on each hand resting on top of your thighs. Then using your thighs to help raise the dumbbells, lift the dumbbells one at a time so you can hold them in front of you at shoulder width with the palms of your hands facing each other.
Dumbbell Pullover	Dumbbell pullovers are a bit of an exercise anomaly in that they work two opposing muscles simultaneously: the chest and the back muscles. The chest muscles are the primary movers, but several muscles of the back assist during the movement. Because you hold the weight directly over your face, consider having a spotter available when performing this exercise.
One Arm Dumbbell Row	One-arm dumbbell row is an exercise for the muscles of the back and arms, including the latissimus dorsi, rhomboids, middle trapezius, rear deltoids and biceps. The row is a pulling motion that is opposite to pressing exercises like the bench press.
Lateral Raise and Front Raise	Lateral raises and forward, or front, raises are exercises that many people do when working their shoulders with weights. These exercises are similar in a number of ways, but distinct differences may determine which ones you emphasize and how often you do them. It is good to include both in a well-rounded shoulder workout.

Seated/Bent Over Laterals	Bent-over lateral raise is an isolating exercise that targets the rear deltoid head and develops strength and density throughout the shoulder region.
Back Hyperextension	Hyperextension or back extension is an exercise that works the lower back as well as the mid and upper back, specifically the erector spinae.
Bird Dog	Bird Dog exercise is a classic core exercise that emphasizes lower back strength and balance. If you've never done it before, the first few reps make seem awkward and difficult to balance, but once you get the form down, you'll want to make it a staple in your exercise program.

Notes

Unit 3.10: Nervous System

Unit Objective

At the end of this unit, the participant will be able to:

1. State the parts of the nervous system
2. State the functions of the nervous system

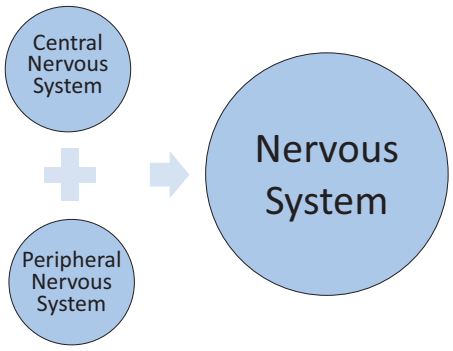
3.10.1 Parts of the Nervous System

Every organisation has a regulatory body, the nervous system is the main authority that controls, regulates and communicates. The endocrine system and the nervous system are both responsible maintaining homeostasis.

Nerve Cells – How They Work

The neuron or the nerve cell is the basic functional unit of the nerve. The sensory and motor nerves transmit information in the form of electric energy. This id called nerve impulse. These originate in the central nervous system (CNS). The CNS are specialized nerve cells called "receptors" which are sensitive to pain, temperature, pressure and changes in the body. The nervous system receives, analyses and stores information about internal and external conditions through its receptors.

The two nervous systems work together. They collect information from inside the body and from the environment outside. They then process the information and send instructions to the rest of the body.



3.10.1 Parts of the Nervous System

3.10.2 Functions of the Nervous System

Central Nervous System (CNS)

The CNS is the main control centre of the body. It is composed of the spinal cord and the brain.

Peripheral Nervous System (PNS)

PNS is made up of pairing nerves. Cranial nerves are paired with the brain. There are 12 pairs of cranial nerves. Spinal nerves are paired with spinal cord. There are 31 pairs of spinal nerves. PNS includes:

- Sensory receptors
- Sensory neurons
- Motor neurons

Sensory Receptors: They are stimulated by a stimulus in the internal or external environment, which then transforms into an electric signal that is transmitted to sensory neurons.

Sensory Neurons: They connect the sensory receptors to the CNS which processes the signal and transmits a message back to the effector organ with the help of a motor neuron.

PNS is also divided into Afferent Division and Efferent Division

Afferent (Sensory) Division: This division transmits information from the periphery to the CNS.

Efferent (Motor) Division: This division carries information from the CNS to the rest of the body. It is again divided into:

- **Autonomous Nervous System:** This is an involuntary system and works automatically without voluntary input. It includes receptors within viscera or internal organs. Examples: Movement of food through the digestive tract during sleep, secretion of hormones, heart rate and breathing.
- **Somatic Nervous System:** This is the voluntary nervous system. It controls the voluntary contractions of the skeletal system. The efferent part of the somatic system is further divided into sympathetic and parasympathetic systems.
    - Sympathetic System: Here, the nerves gather energy for the `fight or flight' reaction during stress. This increases the blood pressure, breathing rate and blood flow to the muscles.
    - Parasympathetic System: Here, the nerves have a calming effect. They slow the heartbeat and breathing rate. They also help in digestion, store energy and promote growth.

Neurons

The nervous system acts like the electrical wiring in the body. It is made up of nerves. These are cylindrical bundles of fibres that begin at the brain and spinal cord. From here they branch out to other parts of the body. This complex group of nerves and specialized cells are called neurons. They transmit signals and messages between the CNS and the rest of the body.

How it Works?

Soma: The neurons are made up of a cell body called the soma. Short fibrous branches called the dendrites extend from the neurons. These act as input channels that receive information from other neurons.

Axon: The axon is a long branch or fibre which extends from the neurons. This transmits signals away from the body and acts like an output channel.

The neuron sends messages through the axon to other neurons. It may also send messages directly to muscles or glands. The neurons have a large number of branching dendrites. However, they have only one axon.

Synapse: In order to send or transmit signals, the neurons have to be linked to each other. This connection between two neurons is called a synapse.

Neuromuscular Junction: When a nerve is connected to a muscle, it forms a special synapse called the neuromuscular junction or motor endplate.

Neurotransmitters: These are chemicals that are released when a nerve impulse travels across a neuron or synapse. These chemicals take the nerve signal from the synapse to another neuron. These nerve impulses are then transmitted along the entire length of an axon.

Myelin Sheath: This is a coating of fatty substances on some axons. It helps the nerves to transmit impulses faster. It is divided into segments with small spaces between each segment.

Nodes of Ranvier: The spaces between the myelin sheath are called the nodes of ranvier. The myelin sheath and node of ranvier together provide electrical insulation to enable rapid and quick transfers of signals.

Motor Units

The motor unit is the functional unit of the neuromuscular system. The skeletal system is controlled by nerve cells called motor neurons. Each motor neuron controls many muscle fibres in a group called the motor units.

This group of motor units work in tandem to coordinate the contractions of a single muscle. The fibres in the motor unit are of the same type. All these fibres contract when a motor unit is activated.

The CNS increase the muscle force by engaging more motor units or by expanding the firing frequency of previously engaged motor units.

The CNS recruits these motor neurons in a systematic fashion, starting with the smallest to the largest motor units. This is based on the size of the load. If the load is small and requires less force, then slow twitch, low force, fatigue resistant muscle fibres are activated. This is done before the engagement of the fast twitch, high force, less fatigue resistant muscle fibres.

Proprioception

Proprioception is the body ability to sense movements within the joints and the position of the joints. This system comprises of sensory receptors that are located in the muscles, joints and ligaments around the joints.

This is a subconscious system and does not allow us to think about movements or corrective actions for the movements. These reactions are very fast and so are called reflexive actions. It is also called the sixth sense.

The two important proprioceptors are Muscle Spindle (MS) and Golgi Tendon organ (GTO).

- **Muscle Spindle:** It is located in the muscle belly and stretches along with the muscle. When the MS is activated, it creates a reflexive contraction in the agonist muscle and relaxation in the antagonist muscle. This process is called as reciprocal inhibition. Example – Reciprocal Inhibition. A person is able to increase the height of the vertical jump when they squat down before jumping.
- **Golgi Tendon Organ:** It is located between the muscle belly and its tendon. The GTO is activated when the muscle contracts. It responds by obstructing the contraction and contracting the opposite muscle group. This process is called autogenic inhibition.
- **Role of GTO in Flexibility:** The muscle can be stretched further when the GTO obstructs the muscles contraction and allows the antagonist muscle to contract easily. Example – Autogenic Inhibition and GTO Response. Low force long duration stretch. After 7-10 minutes of static stretching, the muscle tension increases and activates the GTO response. This causes the muscle spindle in the stretched muscles to be inhibited for some time. This makes the muscle stretch further.

Notes

Unit 3.11: Acute and Chronic Response to Training

Unit Objective

At the end of this unit, the participant will be able to:

1. List the key terms used to explain the response of the body
2. Explain the acute and chronic responses of the body to CR exercise and resistance exercise

3.11.1 Acute and Chronic Response to CR Exercise

We have seen till now that there are two forms of exercises: CR and strength and endurance exercises. Similarly, the human body also reacts differently to each type of exercise regime.

Key Terms	
Blood Pressure	It is the force exerted by the blood on the walls of the arteries during the ventricles contraction (systole) and the relaxation (diastole) phase. It is measured in millimetres of mercury (mmHg)
Vo2 max	This represents the maximum amount of oxygen consumed by the body in one minute. It is measured in millimetres of oxygen per minute per kilogram of body weight (ml.kg.min) A normal man's VO2 max is 45 and a woman's is 38
Peripheral Resistance	This is the resistance of the blood in the body

Cardiac Output (Q): It is the volume of blood pumped by the heart per minute in litres. Normally the average cardiac output in adults is 4 to 5 litres per minute. The cardiac output of a person increases from 20-40 litres per minute when he/she performs an exercise. This depends on the level of conditioning. There is re distribution of blood flow during exercise. Approximately 95% of the cardiac output is directed to the heart and the skeletal muscles. The cardiac output increase during exercise but does not change during resting period in CR trained people.

Cardiac Output = HR * SV

Stroke Volume (SV): It means the amount of blood that is pumped from the left ventricle (LV) every time the heart beats.

Features of SV:

- SV increases quickly during the first few minutes of exercise and then reaches a maximal level after a workload of 40%-60% of VO2. After the increase in the beginning, increase in exercise intensity is primarily mediated by an increase in heart rate.
- SV can increase from 50ml at rest to 120ml during maximal exercise in the upright position.
- SV higher in trained than untrained people.

- SV is sensitive to body types and position. This means that the mean have more SV because of a bigger heart as compared to women.
- SV improves in supine position, as the blood does not pool into the lower extremities.

Heart Rate (HR): This is the number of times the heart beats per minute (bpm). The average resting heart rate is 60-80bpm. In women the resting heart rate is higher by 10bpm as compared to men. Regular aerobic training lowers the heart rate by 10-15bpm. This happens because over a time the body gets accustomed to CR training by increasing the size of the left ventricle. This results in the heart having to pump fewer times as before to maintain the same CO. So, this leads to a larger SV. Heart rate increases in an even and continous fashion with the work rate and oxygen uptake during vigrous exercise. Maximal heart rate (MHR) might come down or may remain unchanged.

Blood Pressure: In active and healthy people, the systolic blood pressure raises continously with an increase in the intensity of exercise. Generally, the noraml values reach 190-220mmHg. They should not exceed 250mmHg. The dystolic blood pressure comes down marginally or remains unchanged. This happens because of the decrease in periphereal resistance caused by vasodilation of the blood vessels in the muscles that are working during exercise. If systolic blood pressure fails to rise or falls with growing workload, then it is a signal that there is a plateau or decrease in the cardiac output.

Respiratory Response and Adaptation: As we start exercising our breathing increases in direct proportion to the intensity and metabolic needs of the exercise that we are performing. Breathing (Pulmonary Ventialation) is measured in litres of air inahaled and exhaled per minute (L/min). Breathing/ Ventialation grows to meet the demand of exercise by the following methods:

1. An increase in `tidal volume' - This is the quantity of air that is inahaled and exhaled with every breath.
2. An increase in the `respiration' or the breathing rate – This means the number of times a person completes an inahalation or exhalation every minute.

How does Exercise Help?

- Breathing rates increase from 15 breaths per minute to 40 – 50 breaths per minute if the exercise is intense.
- The respiratory system is able to take in more air to move in and out of the lungs raising gas exchange.
- There is improvement in the strength and endurance of the diaphragm and intercostal muscles. This improves the ability of the lungs to breathe in more air for a longer period of time. There is les fatigue and so the muscles become stronger.
- More number of capillaries are formed in the lungs, thus increases the flow of blood in and out of the lungs. This also improves the oxygen uptake as the lungs get a bigger area for gaseous exchange.

3.11.2 Acute and Chronic Response to Resistance Training

Resistance training increases the cross- sectional area of the muscle fibres. These are also known as muscle hypertrophy. This occurs in muscles in Type 1 (slow twitch) and Type 2 (fast twitch) muscle fibres. Type 2 muscle fibres have a greater response. An increase in the muscle strength and power is due to the increase in the cross-sectional area.

The two types of hormones that respond to resistance training are:

1. Protein (growth hormone and insulin)
2. Steroid (testosterone and oestrogen)

Resistance training severely increases the concentration and release of both anabolic and catabolic proteins and steroid hormones. Growth hormones, testosterone and insulin are anabolic hormones. They help in the growth and recovery of muscle tissue after a resistance workout. Chronic adaptations result in increased resting levels of testosterone.

Skeletal muscle adaptation is seen by a growth in mineral density (BMD). Chronic adaptation results in a growth in lean tissue. This increases primarily because of muscle hypertrophy from regular resistance training. The connective tissue becomes stronger due to exercise. This makes the skin tighter and results in a younger looking body.

Notes

Exercise

Answer the following questions:

1. Match the following body positions to their anatomical terms

Anterior / Ventral	Towards the feet
Superior	Towards the front
Inferior	Away from the trunk
Lateral	Towards the head
Distal	Region of the back between stomach and pelvic
Superficial	Top surface of feet and hands
Thoracic	Away from the middle of the body
Lumbar	Region between the neck and the abdomen
Dorsal	Closer to the body surface
Pronation	Lying face down

2. The axial skeleton has _____ bones.
   a. 80
   b. 72
   c. 60
   d. 90

3. The shoulder girdle comprises of the _____and _____.
   a. Collar bone (clavicle) and shoulder blade (scapula)
   b. Sacrum and the coccyx
   c. Ribs and the sternum
   d. Cranium and the sternum

4. _____ is the only voluntary muscle in the body.
   a. Cardiac muscle
   b. Skeletal muscle
   c. Smooth muscles
   d. Stabilizer muscles

5. One of the games that can be played to exercise the rotator muscles is
   a. Football
   b. Basketball
   c. Swimming
   d. Volley ball

6. The pulmonary circuit pumps _____blood from the heart to the lung.
   a. Deoxygenated
   b. Filtered
   c. Oxygenated
   d. Muddled

7. The heart is shaped like a _____.
   a. Cylinder
   b. Pear
   c. Cone
   d. Apple

8. _____ is an imaginary line around which a lever rotates.
   a. Torque
   b. Lever
   c. Momentum
   d. Fulcrum

9. Name five alternate forms of aerobic exercises
   a. _____
   b. _____
   c. _____
   d. _____
   e. _____

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4. Introduction To Nutrition

Unit 4.1 – Nutrients and their functions

Unit 4.2 – Categories of nutrients

Unit 4.3 – Nutritional and weight loss recommendation

Unit 4.4 – Dietary guidelines

(BWS/N3001)

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. State the nutrients required by the human body
2. State the function of each nutrient in the body
3. State the nutritional and weight loss recommendations
4. State the dietary guidelines

Unit 4.1: Nutrients and their Functions

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the different categories of nutrients
2. State the importance of nutrients

4.1.1 Categories of Nutrients

The process of taking in nutrients from the food you eat is called nutrition. The process includes ingestion, digestion, absorption, and metabolism of food and the consequent soaking up of nutrients into the tissues. A nutrient is a material that is found in food that provides nourishment to the body.

Nutrients are divided into six different categories:

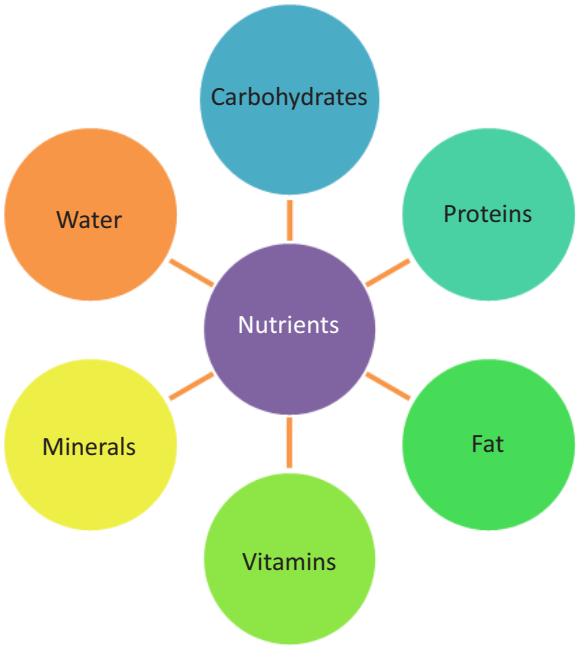

Fig. 4.1.1. Categories of Nutrients

4.1.2 Importance of Nutrients

Each nutrient has a different role to play in the functioning of the body. These nutrients are essential for our body to function properly.

Figure 4.1.2. Functions of Nutrients

Notes

Unit 4.2: Categories of Nutrients

Unit Objectives

At the end of this unit, the participant will be able to:

1. Define macronutrients and micronutrients
2. State the function and sources of carbohydrates
3. State the function and sources of fats
4. State the function and sources of proteins
5. State the functions of water
6. State the functions and sources of vitamins
7. State the functions and sources of minerals
8. Analyse the balanced diet chart

4.2.1 Macronutrients and Micronutrients

Our body needs a lot of nutrients to survive and work. Our diet is divided into two categories of nutrients, Macronutrients and Micronutrients.

Macro means big or large. Macronutrients are those that are needed by the body in large quantities. They repair our body and help it to grow and develop.

Micro means small. Micronutrients are those that are needed in much smaller quantities. They help our body to maintain its energy levels, metabolism, cellular function, and physical and mental wellbeing.

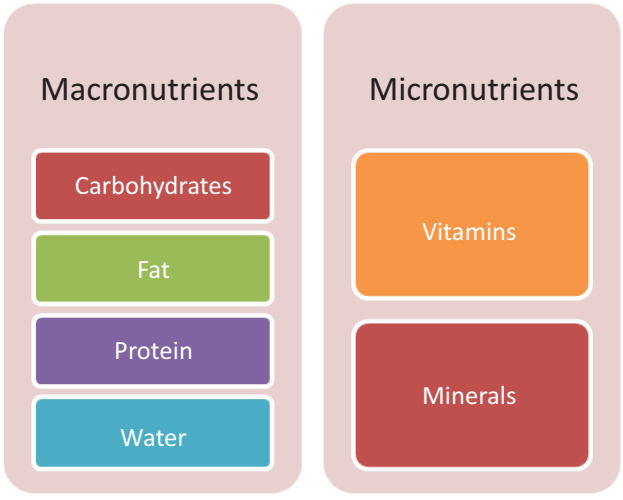

Fig. 4.2.1. Categories of Macronutrients and Micronutrients

4.2.2 Carbohydrates

Carbohydrates are molecules built of carbon (carbo) and hydrogen (hydrate; water).

The formula of carbohydrate is CH2O. This means that the molecular ratio of carbon, hydrogen and oxygen is 1:2:1 in all carbohydrates.

Carbohydrate is an important fuel during exercise and is a crucial component of the diet. During anaerobic activities, carbohydrates are the primary fuel for the exercising muscles. Carbohydrate-rich foods include grains, potatoes, pasta and rice.

Carbohydrates are further divided into four categories:

Classification of Carbohydrates			
Mono-sacchrides - Glucose (Dextrose or Grape Sugar) Fructose (Fruit Sugar) Galactose (Brain Sugar)	**Disaccharides-** Maltose (Malt Sugar) Sucrose (Table Sugar, Cane or Beet sugar) Lactose (Milk Sugar)	**Polysaccharides -** Plant Starch (Grains & Vegetables) Animal Glycogen (Meat Products & Seafood)	**Fibre -** Soluble and Insoluble Dietary Fibre (Apple)

Fig. 4.2.2. Classification of Carbohydrates

4.2.2.1 Monosaccharides

Monosaccharides constitute the basic unit of a carbohydrate. Glucose, fructose and galactose are the three types of monosaccharides. Glucose is also called dextrose or table sugar. Fructose is known as fruit sugar. Galactose is present in very small amounts in our body, however a large amount is released after the digestion of the disaccharide milk sugar. Fructose and Galactose must be converted into glucose (or lactate) before they can be oxidized.

Fig. 4.2.2 (a)Table Sugar

4.2.2.2 Disaccharides

Dissacharides are a mix of two monosaccharides. Disaccharides and monosaccharides are together called sugars: simple sugars or simple carbohydrates sucrose, lactose, and maltose are the most important disaccharides. Sucrose is made up of glucose and a fructose molecule combined together. Foods that have sucrose are beet and cane sugar, brown sugar, table sugar, maple syrup, and honey. Lactose or milk sugar is found in milk and is a combination of glucose and galactose.

Fig. 4.2.2 (b) Brown Sugar

Maltose or malt sugar is a combination of two glucose molecules. It is present in beer, cereals and in germinating seeds. Maltose is present in small quantities in our diet.

4.2.2.3 Polysaccharides

Polysaccharides consist of ten or more monosaccharaides. They are combined in a long chain for example starch, glycogen and fibre. These polysaccharides are the storage houses of carbohydrates. Starch, or complex carbohydrates, is present in seeds, rice and corn. Grains that make bread, cereal, pasta and pastries also contain a large amount of carbohydrates. Starch is the storage house of carbohydrates in plants.

Fig 4.2.2 (c). Rice and Corn

We consume about 50% of starch as our total daily carbohydrate intake. Carbohydrates in humans and animals are stored in the form of glycogen. In a healthy person glycogen is stored in the liver (80-100grams) and in the skeletal muscles (80-100grams).

4.2.2.4 Fibre

Dietary fibre is also called roughage. It consists of the edible parts of plants that are not broken down and absorbed in the human gastrointestinal tract. Fibres are present largely in plants. It is the non-digestible part of a plant such as cellulose. Dietary fibre is divided into soluble and insoluble fibre. The soluble fibre dissolves well in water, insoluble fibres do not dissolve in water. Some of the polysaccharides cannot be digested as the human small intestine does not have the enzymes to break it down.

Thus, carbohydrates can be classified as simple (sugars) or complex carbohydrates (starches) depending on their food sources. Given below are the sources of food products and the type of carbohydrates that they contain.

Types of Carbohydrates	Food Rich In Carbohydrates	Pictures
Simple carbohydrates	• Fruit Juices • Fruits • Sweetened cereals • Baked Products • Jams • Sweets • Sports drinks • Beet and cane sugar • Brown sugar and Table Sugar • Maple syrup and honey	 *Fruit Juices*  *Fruits*

Starches	• Cereal • Potatoes • Pasta • Macaroni • Rice • Bread	 *Pasta*  *Bread*
Fibre	• Whole-grain cereals • Breads • Oats • Dried Beans and Peas • Fruits and Vegetables	 *Oats*  *Whole-grain cereals*

4.2.3 Fats

Fats are essential nutrients that our body needs. The fats that are found in foods we get from plants and animals are known as dietary fat. Fat acts as a fuel source for our body. It is also, the major storage form of energy in the body.

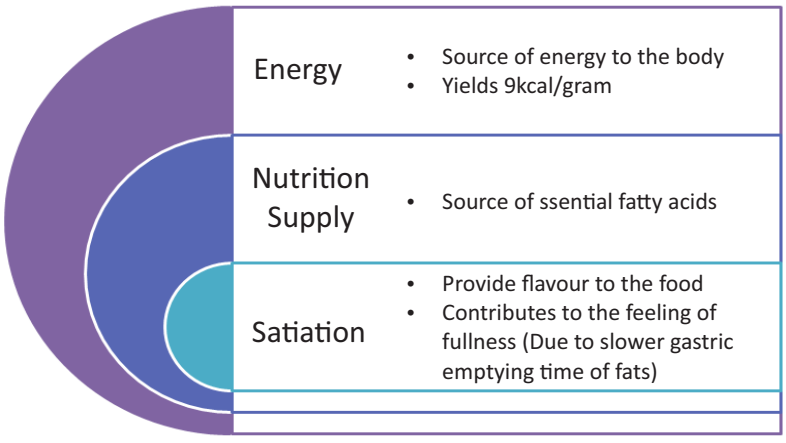

Fig. 4.2.3 (a) Benefits of Fat in the Body

Thermal Insulation	Fat under the skin help to control the body temperature
Organ Protection	Adipose fat that surrounds the vital organs protect them from mechanical shock.
Cell Membrane Structure	Fat is a part of cell membrane
Nerve Transmissions	Fats stored around the nerve fibre help in nerve impulse transmissions and electric insulations.
Cholesterol	This is a fat which is helps in the formation of bile

Fig. 4.2.3.2. Functions of Fat in the Body

4.2.3.1 Chemical Nature of Fats

The chemical name given to fat or fat like compounds is Lipids. Just like carbohydrates, fats are also made up of carbon, hydrogen and oxygen. However the proportion of oxygen is much less in fats as compared to carbohydrates. Some lipids also contain phosphates or nitrogenous compounds.

Saturated Fatty Acids	Unsaturated Fatty Acids
Considered to be non-essential fatty acids because the human body can synthesize them from other nutrients like carbohydrates and other unsaturated fatty acids	Important part of a healthy diet. They reduce the risk of heart disease and lower cholesterol levels. These come in liquid form at room temperature.
Required in small quantities as it can lead to an increase in “bad cholesterol”.	There are two main types of unsaturated fats: Monounsaturated (MUFA) and polyunsaturated fatty acids (PUFA).
They should make-up no more than ***10% of our total diet.***	They should make-up no more than ***30% of our total diet.***

Sources of Saturated Fatty Acids		
Animal-based products	**Plant-derived products**	**Manufactured and packaged foods**
• Dairy foods – such as butter, cream, full fat milk and cheese • Meat – such as fatty cuts of beef, pork and lamb and chicken	• Palm oil • Coconut • Coconut milk and cream • Cooking margarine	• Fatty snack foods (such as pizza, burgers, potato chips, cookies, pastries etc.)
		
Butter	*Palm Oil*	*Cookies*

Sources of Unsaturated Fatty Acids		
Monounsaturated fatty acids (MUFA)	**Polyunsaturated fatty acids (PUFA)**	**Essential fatty acids**
They are found in a variety of foods and oil Example: • Olive oil • Canola oil • Avocados • Nuts such as cashews and almonds.	They are found mostly in plant-based foods and oils Example: • Olive oil • Canola oil	These cannot be synthesized by the body and hence must be provided through diet. Example: • Alpha-linoleic (Omega-3) found in fish • Linoleic (Omega-6) acid
 *Olive Oil*	 *Canola Oil*	 *Alpha – Linolenic (Omega – 3)*

Note: When the essential fatty acids are replaced by the saturated fats in the diet, they are known to reduce the risk of heart disease and lower cholesterol levels. The American Heart Association recommends that for good health, majority of the fats that you eat should be monounsaturated or polyunsaturated.

4.2.3.2 Cholesterol

Cholesterol is a type of fat found in the blood. It is a wax like substance that is found in the body and food. The main source of cholesterol is foods from animal sources such as meat, poultry and full-fat dairy products. The liver will produce more cholesterol if a person eats a diet high in saturated and *trans* fats.

Cholesterol does not dissolve in the blood. It is transported through the blood stream by carriers called lipoproteins. The two types of lipoproteins are:

LDL	HDL
They are also called Low Density Lipoproteins	They are called High Density Lipoproteins
This is the `bad' cholesterol as it creates a hard deposit that can clog arteries	This is the `good' cholesterol as HDL acts as a scavenger to remove LDL from the arteries and carries it to the liver to be excreted
Note: High cholesterol foods should represent ***less than300mg/day*** of total intake of fat.	

4.2.3.3 Triglycerides

Triglycerides are also a type of fat. It stores excess energy from one's diet. High levels of triglycerides in the blood are associated with atherosclerosis. This disease causes plaque to build up in the arteries. The causes of increase in triglycerides are obesity, physical inactivity, cigarette smoking, excess alcohol consumption and a diet very high in carbohydrates (more than 60 percent of total calories).

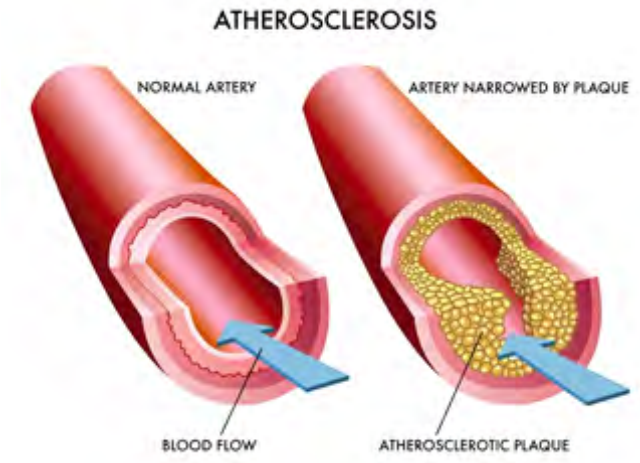

Fig. 4.2.3 (b) Atherosclerosis

4.2.4 Proteins

Proteins are made up of amino acids. Amino acids are bound by so-called peptide bonds, and once connected they are called a peptide. Most proteins are polypeptides combining up to 300 amino acids.

Examples of proteins are:

1. Actin
2. Tropomyosin
3. Troponin
4. Myosin

All these four come together to make up the contractile protein in the muscle.

There are twenty different types of amino acids that are commonly found in proteins. Humans can synthesise eleven of these amino acids. The human body cannot manufacture the other nine amino acids. The amino acids that cannot be synthesized are called essential amino acids. Vegetarians often compensate by eating more grains and legumes, both of which are excellent source of protein. However, they do not contain all essential amino acids. Grains lack the essential amino acid called **lysine**.

Both the amount and the quality of protein are important in the food that we eat. These are of two types:

4.2.4.1 Complete Proteins and Incomplete Proteins

Proteins that contain all the essential amino acids are called complete proteins or high-quality proteins. Animal protein is considered a high quality not only because all essential amino acids are present but also because they are present in larger quantities and in proper proportion.

Proteins that are deficient in one or more amino acids are called ***incomplete proteins*** and they are commonly referred to as low-quality proteins. Incomplete proteins cannot support human life and growth.

Essential and Non-Essential Amino Acids	
Essential Amino Acids	**Non- Essential Amino Acids**
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine

4.2.4.2 Functions of Proteins

The functions of proteins are:

- Helps in maintenance and repair of body tissues including hair, skin, eye, muscles and organs
- Helps in synthesis of hormones e.g. insulin
- Helps to increase the rate of chemical reactions in the body through enzymes
- Helps in the formation of antibodies that helps prevent infection and illness

4.2.4.3 Recommended Intake of Nutrients

The suggested intake of nutrition for a person is based on data from nitrogen balance studies. The amount of nutrition intake depends on age and gender. The recommended protein intake also varies worldwide from 0.8 to 1.2 g/kg of body weight.

Recommended Intake of Nutrients		
NUTRIENT	**% OF CALORIC INTAKE (US RDA)**	**CALORIES PER GRAM foods**
Carbohydrate	55% to 65	4 kcal/g
Fats	20% to 30%	9 kcal/g
Proteins	12% to 20%	4 kcal/g

4.2.5 Water

The adult body is made up of 60-70% water. So if a person's weight is 70kilograms, then 40 kilograms is the water component of his/her body. The content of water differs from tissue to tissue in the body. The proportion of water in different body compartments also differs. About two-thirds of body water is found inside cells this is called ***intracellular fluid***. The remaining one-third is found outside cells and is called ***extracellular fluid***. Extracellular fluid consists of water in the blood, lymph, cerebrospinal fluid as well as in the fluid found between cells, this is called ***interstitial fluid***.

Body Parts	Water Content
Blood	90%
Muscle	75%
Bone	25%
Adipose Tissue	5%

4.2.5.1 Functions of Water

There are two major functions of water in the body – Transporting Function and Protecting Function.

Transport Functions:

- Transporting nutrients throughout the body
- Participating in biochemical reactions
- Providing the medium for biochemical reactions take place (blood transports nutrients and oxygen to the tissues and transports carbon dioxide and waste products away from the tissues)
- Transporting waste products such as urea, excess salt, and ketones out of the body

Protective Functions:

- Lubricating (synovial fluid) the joints
- Controlling body temperature (thermo-regulation)

4.2.5.2 Factors that Affect Water in the Body

The factors that influence the water volume in the body are:

- Food and drink intake
- Sweat
- Urine and stool excretion
- Energy expenditure

The amount of water an adult can take in a day is 2.0 to 2.8 L/day. When a person performs an exercise, it increases the body temperature. This causes the blood vessels in the skin to dilate, resulting in blood to flow close to the surface of the body to release heat.

For every 4KJ of energy expended, 1ml of fluid is needed or 1 ml/kcal. Of the daily 2.0L to 2.8L consumed, 1.0 to 1.5 L is usually in the form of fluids, and the rest is obtained from foods.

4.2.6 Vitamins

Vitamins are substances that perform different tasks within the human body to promote growth and prevent illnesses. The human body depends on available animal and plant sources for replenishment as it does not synthesize vitamins. The best way to get vitamins is by eating a balanced diet.

Types of Vitamins

There are two distinct kinds of vitamins are present in the body:

Fat-soluble vitamins	Water-soluble vitamins
A, E, D and K	**B and C vitamins**
• These are found in fatty foods • These are stored in the liver or adipose tissue to be used later or when needed	• These cannot be stored in the body and are readily excreted in urine.
• Fat-soluble vitamin cannot be absorbed by the body if fat absorption is impaired. • It can lead to toxicity from over consumption.	• These do not cause toxicity from over consumption • It is important to fulfil the requirement through regular intake

4.2.6.1 Vitamins and Their Sources of Food

Fat Soluble Vitamins		
Nutrient	**Source**	**Pictures**
Vitamin A **Beta-carotene**	Animal sources, fortified milk, cheese, butter, eggs From plant sources: Leafy vegetables, dark green vegetables; dark orange fruits (apricots, cantaloupe) and vegetables (carrots, winter squash, sweet potatoes, pumpkin)	 *Dark Orange Fruit (Apricots)*
Vitamin D	Egg yolks, liver, fatty fish, fortified milk, fortified margarine. When exposed to sunlight, the skin can make vitamin D.	 *Egg Yolk*

Vitamin K	Leafy green vegetables and vegetables in the cabbage family; milk; also produced in intestinal tract by bacteria	 *Milk*

Water Soluble Vitamins – 1		
Nutrient	**Source**	**Pictures**
(Vitamin B1) Thiamine	Whole-grain or enriched breads and cereals, legumes, nuts and seeds	 *Whole Grain*
(Vitamin B2) Riboflavin	Milk and milk products; leafy green vegetables; whole-grain, enriched breads and cereals	 *Milk and Milk Products*
(Vitamin B3) Niacin	Meat, poultry, fish, whole-grain or enriched breads and cereals, vegetables (especially mushrooms, asparagus, and leafy green vegetables), peanut butter	 *Meat*
(Vitamin B6) Pyridoxine	Meat, fish, poultry, vegetables, fruits	 *Vegetables*

(Vitamin B12) Cobalamin	Meat, poultry, fish, seafood, eggs, milk and milk products; not in plant source	 *Seafood*

Water Soluble Vitamins - 2		
Nutrient	**Source**	**Pictures**
Pantothenic Acid	Widespread in foods	
Biotin	Widespread in foods; also produced in the intestinal tract	
Folic acid	Leafy green vegetables and legumes, seeds, orange juice, and liver; now added to most refined grains	
(Vitamin C) Ascorbic acid	Fruits: strawberries, papayas, mangoes, kiwifruit, all citrus fruits Vegetables: cabbage, lettuce, pepper, tomatoes, potatoes	

4.2.6.2 Functions of Vitamins:

The functions of vitamins are:

- Breaking down proteins by working in combination with other nutrients
- Facilitating the growth of cells, tissues and bones
- Promoting a healthy immune system

4.2.7 Minerals

Minerals are nutrients that are needed in small amounts to keep the body healthy. Minerals do not provide energy or calories to the body. They keep our bones strong and the body in balance. The minerals have to be ingested by a balanced diet as the body does not make minerals.

Minerals are divided in two categories:

- Major minerals (macro-minerals). These are needed in large amounts.
- Trace minerals (micro-minerals). These are needed in small amounts.

4.2.7.1 Minerals and Their Sources in Food

Major Minerals		
Nutrients	**Source**	**Pictures**
Sodium	Table salt, soy sauce; large amounts in processed foods; small amounts in milk, breads, vegetables, and unprocessed meats	 *Sodium - Table Salt*
Chloride	Same as above	 *Chloride – Soy Sauce*

Potassium	Meats, milk, fresh fruits and vegetables, whole grains, legumes	 *Potassium – Legumes*
Calcium	Milk and milk products; canned fish with bones (salmon, sardines); fortified tofu and soy milk, broccoli, mustard, legumes	 *Calcium – Broccoli*
Phosphorous	Meat, fish, poultry, eggs, milk, processed foods	 *Phosphorous – Eggs*
Magnesium	Nuts and seeds; legumes; leafy, green vegetables; seafood; chocolate; "hard" drinking water	 *Magnesium – Chocolate*
Sulphur	Occurs in foods as part of protein: meats, poultry, fish, eggs, milk, legumes, nuts	 *Sulphur – Meat*

Trace Minerals		
Nutrients	**Source**	**Pictures**
Iron	Organ meats; red meats; fish; poultry; shellfish (especially clams); egg yolks; legumes; dried fruits; dark, leafy greens; iron-enriched breads and cereals; and fortified cereals	 *Iron – Dried Fruits*
Zinc	Meats, fish, poultry, leafy whole grains, vegetables	 *Zinc – Vegetables*
Selenium (Antioxidant)	Meats, seafood, grains	 *Selenium – Grains*
Copper	Legumes, nuts and seeds, whole grains, organ meats, drinking water	 *Copper – Drinking Water*
Manganese	Widespread in foods, especially plant foods	 *Manganese – In Food*

Fluoride	Drinking water (either fluoridated or naturally containing fluoride), fish, and most teas	 *Fluoride – Tea*
Chromium	Unrefined foods, especially liver, brewer's yeast, whole grains, nuts, cheeses	 *Chromium – Cheese*

4.2.7.2 Functions of Minerals:

The functions of minerals are:

- Forming and strengthening bones and teeth
- Producing energy by assisting in the formation of red blood cells
- Promoting proper functioning of nerves and muscles
- Strengthening the immune system strong
- Fighting against infection, healing wounds and repairing cells
- Regulating enzyme activity
- Maintaining acid-base balance

4.2.8 Balanced Diet Pyramid

Fig. 4.2.8 Balanced Diet Pyramid

GRAINS Make half your grains whole	VEGETABLES Vary your veggies	FRUITS Focus on fruits	MILK Get your calcium-rich foods	MEAT & BEANS Go lean with protein
Eat at least 3 oz. of whole-grain cereals, breads, crackers, rice, or pasta every day 1 oz. is about 1 slice of bread, about 1 cup of breakfast cereal, or 1/2 cup of cooked rice, cereal, or pasta	Eat more dark-green veggies like broccoli, spinach, and other dark leafy greens Eat more orange vegetables like carrots and sweetpotatoes Eat more dry beans and peas like pinto beans, kidney beans, and lentils	Eat a variety of fruit Choose fresh, frozen, canned, or dried fruit Go easy on fruit juices	Go low-fat or fat-free when you choose milk, yogurt, and other milk products If you don't or can't consume milk, choose lactose-free products or other calcium sources such as fortified foods and beverages	Choose low-fat or lean meats and poultry Bake it, broil it, or grill it Vary your protein routine — choose more fish, beans, peas, nuts, and seeds
For a 2,000-calorie diet, you need the amounts below from each food group. To find the amounts that are right for you, go to MyPyramid.gov.				
Eat 6 oz. every day	Eat 2 1/2 cups every day	Eat 2 cups every day	Get 3 cups every day; for kids aged 2 to 8, it's 2	Eat 5 1/2 oz. every day

Balanced Diet Chart

Fig. 4.2.8 Balanced Diet Pyramid

Notes

Unit 4.3: Nutritional and weight loss recommendation

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the nutritional recommendations to keep a body healthy
2. State the recommendations for weight loss

4.3.1 Nutritional Recommendations

If a person wants to keep his/her body healthy and fit , then two things are very important, eating right and exercising right. To achieve a healthy weight, it is important to balance the food intake with the physical activity.

Nutritional Recommendations	
Eat & Drink More of	**Eat & Drink Less of**
• Whole grains	• Simple or refined foods
• Dark green, red and orange vegetables (broccoli, carrots, spinach)	• Starchy vegetables (white potatoes, corn)
• Seasonal whole fruits	• Fruit juices
• Low fat or fat free milk and milk products	• Whole milk and milk products
• Mono or polyunsaturated fats oils (Always in moderation)	• Saturated or trans fats
• Lean meats and beans products	• High fat meats e.g. chicken with skin

Nutritional Recommendations	
Food Products – Intake to be Reduced	**Amount that Can be Consumed**
Sodium	• 2300mg/day (approximately 1 teaspoon of salt) for a healthy adult • 1500mg/day for individuals over the age of 50 and those with hypertension and diabetes
Saturated fats	• Less than 10% of total intake of fat per day
Trans fats	• Avoid or keep to a minimum
Alcohol	• 1 drink per day for women and 2 drinks per day for men

4.3.2 Weight Loss Recommendation

- The ACSM recommends 150 to 250 minutes per week of moderate-intensity physical activity. This will help in modest weight loss. The current public health recommendation for physical activity is for individuals to take part in at least 30 minutes of moderate-intensity physical activity, preferably all days of the week.
- An energy deficit of 500 to 1,000 kilocalories (kcal) per day achieved through reductions in total energy intake is recommended.
- Guideline for a healthy weight loss recommends ½ kg or 1pound of weight loss per week.
- Reducing dietary fat intake to less than 30 percent of total energy intake will lead to weight loss.

Unit 4.4: Dietary Guidelines

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the dietary guidelines recommended by health councils

4.4.1 Dietary Reference Intake (DRI)

DRI has replaced RDA as it has recommendations for 50 nutrients that include 14 vitamins, 18 minerals and 18 other nutrients. It is the new standard, which states the amount of nutrient intake while planning and assessing diets for healthy people. Think of DRI as the umbrella term that includes the following values:

- **Recommended Dietary Allowance (RDA):** This is the average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97 to 98 percent) healthy individuals.
- **Adequate Intake (AI):** This is a value based on observed or experimentally determined approximations of nutrient intake by a group of healthy people. It is used when RDA cannot be determined.
- **Tolerable Upper Intake Level (UL):** This is the highest level of daily nutrient intake which is likely to pose no risk of adverse health effects to almost all individuals in the general population. As intake increases above the UL, the risk of adverse effects increases.
- **Estimated Average Requirement (EAR):** This is the nutrient intake value that is estimated to meet the requirement of half the healthy individuals in a group.

Summary

- Nutrition is an important part of a person's exercise program and overall wellbeing.
- It is important for gym trainers and fitness instructors to know what healthy eating means and pass this knowledge on to the clients.
- Balance, variety and moderation are the keys to a healthy and fit body.
- Nutritious low fat food choices should be encouraged by the fitness experts.
- Clients should be made aware of healthy eating choices along with a balanced exercise regime. This will help them to build a positive self- image and boost their health.

Notes

Exercise

Q1. **_____ help to promote growth and development of the body.**
a. Proteins
b. Carbohydrates
c. Minerals
d. Fats

Q2. **_____ provide energy to the body.**
a. Proteins
b. Carbohydrates
c. Minerals
d. Fats

Q3. **_____ regulate metabolism in the body.**
a. Proteins
b. Carbohydrates
c. Minerals
d. Fats

Q4. **_____ and minerals are micronutrients.**
a. Vitamins
b. Carbohydrates
c. Proteins
d. Fats

Q5. **Glucose, fructose and galactose are the three types of _____.**
a. Monosaccharides
b. Disaccharides
c. Polysaccharides
d. Fibres

Q6. **Excess consumption of saturated fatty acids can lead to an increase in _____.**
a. Good cholesterol
b. Bad cholesterol
c. High cholesterol
d. Low cholesterol

Q7. **The average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all healthy individuals is called _____.**
a. Adequate Intake (AI)
b. Tolerable Upper Intake Level
c. Estimated Average Requirement
d. Recommended Dietary Allowance

Q8. **Guideline for a healthy weight loss recommends _____ of weight loss per week.**
a. ½ Kg or 1 Pound
b. 1 Kg or 1 Pound
c. 1 Kg or 2 Pound
d. 2 Kg or 2 Pound

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5. Kinesiology

Unit 5.1 – Anatomical Terms used in Exercise

Unit 5.2 – Muscles and their Actions

(BWS/N3001)

Key Learning Outcomes

At the end of this unit, the participant will be able to:

1. List the terms used in anatomy
2. Identify the different types of muscles
3. List the muscles located in the different parts of the body
4. Demonstrate the action which is performed for each muscle
5. Design and analyse exercise as per the action of the muscle

Unit 5.1 - Anatomical Terms used in Exercise

Unit Objectives

At the end of this unit, you will be able to:

1. List the terms used in anatomy

5.1.1 Anatomical Terminology

Anatomical terms are simply words that tell about a point in the body and its relation to other systems in our body. We use these words to tell the movement of the body. For example during an exercise, we will say that this person is standing erect with his head, eyes and palm facing upwards and his feet are slightly apart.

Look at the table below, some anatomical words and what they mean have been given for your reference.

Anterior / Ventral	Towards the front
Posterior / Dorsal	Towards the back
Superior	Towards the head
Inferior	Towards the feet
Media	Near the middle of the body
Lateral	Away from the middle of the body
Proximal	Near the trunk
Distal	Away from the trunk
Superficial	Closer to the body surface
Deep	Beneath the body surface
Cervical	Region of the neck
Thoracic	Region between the neck and the abdomen
Lumbar	Region of the back between stomach and pelvic
Dorsal	Top surface of feet and hands
Palmar	Anterior surface of hands
Supination	Lying face up
Pronation	Lying face down

Notes

Unit 5.2: Muscles and their Actions

Unit Objectives

At the end of this unit, the participant will be able to:

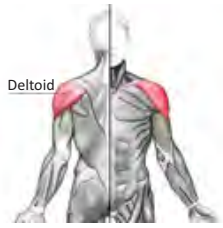
1. Identify the different types of muscles
2. Demonstrate the action which is performed for each muscle
3. Design and analyse the exercise schedule as per the muscle action

5.2.1 Muscles of the Back, Shoulder & Chest

These muscles control actions that include movements of the head and arms. The ribs and chest muscles also control breathing.

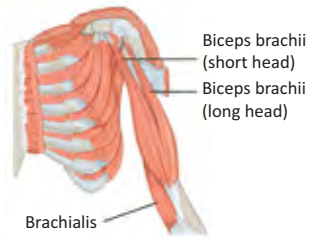
Muscles of the Back, Shoulder & Chest

Picture	Name of the muscle	Where it is Located	Insertio	Action
	Erector Spinae	• Lower thoracic vertebra	• Upper thoracic vertebrae • Cervical vertebrae	• Extension of the vertebral column
	Latissmus Dorsi	• Thoracic • Lumbar vertebrae • Sacrum • Top of pelvis	• Upper part of humerus	• Adduction • Extension • Medial rotation of the arm. • Retraction and depression of shoulder
	Trapezius	• Cervical and thoracic vertebrae • Base of skull	• Clavicle and scapula	• Elevation • Depression • Retraction of the scapula
	Rhomboids	• C7-T5 vertebrae	• Medial border of the scapula	• Retraction and depression of the scapula.

	Deltoid	• Clavicle and spine of scapula	• Upper part of humerus	• Abduction • Extension • Lateral rotation • Flexion • Medial rotation of arm
	Pectrolis Major	• Sternum • Clavicle • 1st-6th ribs	• Upper front area of humerus	• Adduction • Flexion • Medial rotation of arm

5.2.2 Muscles of the Upper Arm

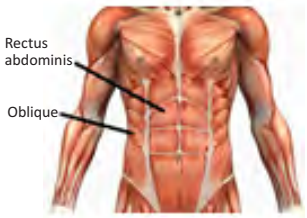
Our arms do a multitude of difficult tasks every day. Some of these tasks like lifting a weight need strength and some like writing or typing need speed and accuracy. The muscles in arm help our arm for these tasks.

Muscles of the Upper Arm				
Picture	**Name of the muscle**	**Where it is Located**	**Insertio**	**Action**
	Biceps Brachii	• Scapula	• Radius	• Flexion of elbow • Supination of forearm
	Triceps Brachii	• Scapula • Upper part of umerous	• Ulna	• Extension of elbow

5.2.3 Muscles of the Abdomen

The diaphragm wall separates the muscles of the lower back from the chest. The abdominal muscles protect the fragile important inner organs which are located in the cavity of the abdomen cavity. These muscles also help to keep the body stable, provide support for the posture and help in the movement of the trunk.

Muscles of the Abdomen

Picture	Name of the muscle	Where it is Located	Insertio	Action
	Rectus Abdominus	• Front lower part of pelvis	• 5th, 6th and 7th ribs • Lowest part of sternum	• Flexion of vertebral column
External Obliques 	External Obliques	• Lower ribs	• Front upper part of pelvis	• Rotation of vertebral column • Compression of abdomen • Flexion of vertebral column
Internal Obliques 	Internal Obliques	• Top of pelvis	• Lowest three ribs	• Compression of abdomen • Flexion of vertebral column • Rotation of vertebral column

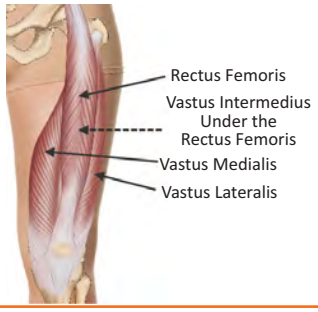
5.2.4 Muscles of the Hip

The most malleable and adaptable part of the human body is the hip joint. There are many muscles of the hip. They give strength and stability to the hip joint. They also help in the movement of the hip and thigh.

These muscles are classified depending on their task and location. They are:

- **Anterior group:** The muscles consist of iliopsoas group and the quadriceps femoris muscles. These muscles bend the thigh at the hip. Activities performed: climbing a ladder, kicking a football etc.
- **Posterior group:** The muscles consist of the largest muscle in our body (gluteus maximus) and the hamstring muscles. These muscles straighten the thigh at the hip. Activities performed: All cardio activities like running, walking, climbing and standing.
- **Adductor group:** These muscles are also called the muscles of the groin. They are found on centre of the thigh. They help to move the thigh to the midline of the body.

- **Abductor group:** These muscles move the thigh away from the body's centre line. A split is a common example of the muscles in this group.

Anterior Group				
Picture	**Name of the muscle**	**Where it is Located**	**Insertio**	**Action**
	• Rectus femoris • Vastus lateralis • Vastus interme dius • Vastus medialis	• Front lower part of pelvis • Upper part of femur	• Top front part of tibia	• Flexion of the femur • Extension of the knee femur

Posterior Group				
Picture	**Name of the muscle**	**Where it is Located**	**Insertio**	**Action**
	• Gluteus Maximus	• Rear part of pelvis, • Sacrum • Coccyx	• Top of femur	• Extension Lateral rotation of leg
	• Gluteus Medius	• Upper part of pelvis	• Outside of upper part of femur	• Abduction Medial rotation of leg
	• Gluteus Minimus	• Mid outer surface of pelvis	• Outside of upper part of femur	• Abduction Medial rotation of leg
	• Hip Flexors	• Lumbar vertebrae • Top of pelvis	• Upper part of femur	• Flexion of femur and vertebral column. Flexion and lateral rotation of leg

Posterior Muscles /Hamstrings

Posterior Muscles /Hamstrings				
Picture	**Name of the muscle**	**Where it is Located**	**Insertio**	**Action**
	Gastrocnemius	• Lower rear part of femur	• Heel bone	• Plantar flexion of foot • Flexion of knee
	Soleus	• Upper rear part of tibia and fibula	• Heel bone	• Plantar flexion of foot

Muscles of the Calf and Foot

Muscles of the Calf and Foot				
Picture	**Name of the muscle**	**Where it is Located**	**Insertio**	**Action**
	• Popliteus	• Knee	• Knee	• Flexion and medial rotation
	• Gastrocnemius	• Knee • Ankle	• Knee	• Flexion of leg upon the knee • Plantar flexion of foot
 	• Tibialis Posterior • Flexor Hallucis Longus • Flexor Digitorum Longus	• Ankle • Subtalar	• Ankle	• Plantar flexion of foot • Inversion of the foot • Flexion of great toe • Flexor hallucis longus, • Flexion of other four toes • Flexor digitorum longus

	• Peroneus Longus • Peroneus Brevis	• Ankle		• Plantar flexion • Eversion of foot
	• Tibialis Anterior	• Ankle • Subtalar		• Dorsiflexion of foot upon the leg • Inversion of foot
	• Extensor Hallucis Longus • Extensor Digitoru m Longus	• Ankle • Subtalar		• Dorsiflexion of foot upon leg • Extension of great toe • Extension of foot • Extension of other four toes

5.2.5 Muscle Action – Designing and analysing the Exercise Schedule

To analyse an exercise one has to first understand how a muscle contracts. The two ways in which this can be found out are:

- Checking the position of the body
- Understanding the direction of the pull of gravity

Three types of contractions occur in muscles. They are:

Concentric Contraction: In this the movement happens against the pull of gravity.

Eccentric Contraction: In this the movement happens in a slow and controlled fashion. It is in the same direction as the pull of gravity.

Concentric Contraction of the Agonist: In this the movement is in the same direction as the pull of gravity but is faster, this is called the concentric contraction of the agonist muscle.

Note: *Agonist muscles are the prime movers. A certain movement occurs because of them. Antagonist muscles act against the agonist muscles.*

Nine questions to ask while analysing an exercise:

1. How will each joint move?
2. How will the movement occur? Will it be slow, fast? Will it be against resistance or not?
3. How will the pull of gravity affect the movement?
4. Which muscles are making the joint move?
5. Is the contraction of the muscles concentric, eccentric or isometric?
6. By doing the movement are you achieving the exercise goal?
7. Is the exercise helping the main function of the muscles?
8. Will this movement harm any other body part?
9. Can the movement be changed to suite the need of the client?

Examples of Some Exercises and the Muscle Movements

Fig. 5.2.5 (a)Push up

Name of the Exercise	Action of the Joint	Name of the Muscle	Muscle Contraction
Push-up			
Down Phase	• Transverse Shoulder • Abduction • Elbow Flexion	• Pectoralis Major • Anterior Deltoid	• Eccentric
Up Phase	• Trunk Stabilization • Transverse Shoulder Adduction	• Triceps • Abdominals	• Eccentric

Jumping Jacks

Fig. 5.2.5 (b) Jumping jack

Name of the Exercise	Action of the Joint	Name of the Muscle	Muscle Contraction
Jumping Jacks			
Outward Position	• Elbow Extension • Trunk Stabilization • Dorsi Flexion • Plantar Flexion • Hip Flexion • Knee Flexion • Hip Abduction	• Pectoralis Major • Anterior Deltoid • Triceps • Abdominals Tibialis Anterior • Gastrocnemius/Soleus • Iliopsoas • Gluteus Maximus • Quadriceps	• Eccentric • Isometric • Concentric • Concentric • Concentric • Isometric • Concentric • Concentric
Inward Position	• Shoulder Abduction • Plantar Flexion • Hip Extension • Knee Extension • Shoulder Adduction	• Gluteus Medius/Minimus • Medial Deltoid • Supraspinatus • Gastrocnemius/Soleus • Gluteus Maximus • Quadriceps • Pectoralis	• Concentric • Eccentric • Eccentric Concentric • Concentric • Concentric • Concentric • Concentric Concentric

Squats

Fig. 5.2.5 (c) Squats

Name of the Exercise	Action of the Joint	Name of the Muscle	Muscle Contraction
Squats			
Down phase	• Hip Adduction • Dorsi Flexion • Hip Flexion	• Latissimus Dorsi • Adductors • Gastrocnemius Gluteus	• Concentric Concentric • Concentric • Eccentric
Up phase	• Knee Flexion • Plantar Flexion • Hip Extension • Knee Extension	• Maximus • Quadriceps • Gastrocnemius Gluteus. Maximus • Quadriceps	• Eccentric • Eccentric • Concentric Concentric • Conceniric

Summary

- Anatomical terms are simply words that tell about a point in the body and its relation to other systems in our body. We use these words to tell the movement of the body.
- Our body is made of different type of muscles. These muscles give us strength, protect internal organs, and help the body in movement and posture. Each muscle is different from the other in terms of its location in the body, placement and use.
- To analyse an exercise one has to first understand how a muscle contracts. The two ways in which this can be found out are:
- Checking the position of the body
- Understanding the direction of the pull of gravity
- As a Gym Assistant, you need to analyze an exercise that the client performs. This should be done by asking relevant and leading questions during the exercise, which will help you understand the working of a muscle during that particular exercise.

Notes

Exercise

Match the anatomical term to its description

Anatomical Term	Description
Inferior	Away from the middle of the body
Distal	Region of the neck
Supination	Away from the trunk
Cervical	Lying face up
Lateral	Towards the feet

Fill in the blanks.

Q1. **Erector Spinae is located in the _____.**
a. Lower thoracic vertebra
b. Thoracic
c. Lumbar vertebrae
d. Top of pelvis

Q2. **One of the actions taken for the Biceps brachii is _____.**
a. Extension of elbow
b. Medial rotation of arm
c. Flexion of elbow
d. Lateral rotation

Q3. **The insertion of the Rectus Abdominus is in the _____.**
a. 5th, 6th and 7th ribs Front upper part of pelvis
b. 4th, 5th and 6th ribs and lowest part of sternum
c. 4th, 5th and 6th ribs and upper part of sternum
d. 5th, 6th and 7th ribs and lowest part of sternum

Q4. **Extension and lateral rotation of leg occurs in the_____.**
a. Hip Flexors
b. Gluteus Minimus
c. Gluteus Maximus
d. Gluteus Medius

Q5. **Gastrocnemius is one of the _____ muscles.**
a. Hamstring
b. Hip
c. Shoulder
d. Abdomen

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6. Flexibility

(BWS/N3001)

Key Learning Outcomes

At the end of this unit, the participant will be able to:

1. State the factors that effect flexibility
2. Explain the physiology of stretching
3. Classify the different types of stretching
4. Understand the principles of flexibility

Unit 6.1: Overview

Unit Objectives

At the end of this unit, the participant will be able to:

1. Define flexibility

Unit 6.1.1: What is Flexibility?

Being flexible is important for fitness and daily activities

Flexibility can be defines as the entire range of ROM (Range of Motion) in a joint or a series of joints that can be achieved with the help of an exercise partner or equipment. Flexibility differs from person to person depending on the muscle length. Thus, flexibility is not general but is a special and precise stretch done for a particular joint or set of joints.

A person can improve his/her flexibility by adding stretches at the end of the exercise when the muscles are warm.

It helps a person to:

- Move freely
- Corrects the posture, appearance and balance of the body

Notes

Unit 6.2: Benefits of Flexibility

Unit Objectives

At the end of this unit, you will be able to:

1. Explain the benefits of flexibility

6.2.1 Benefits of Flexibility

It is important to include flexibility training as a part of your normal exercise routine. Flexibility is as important in aerobic and muscular training as it is to do a regular household task. If done judiciously, flexibility will help a person to become more in tune with their body. The benefits of flexibility are:

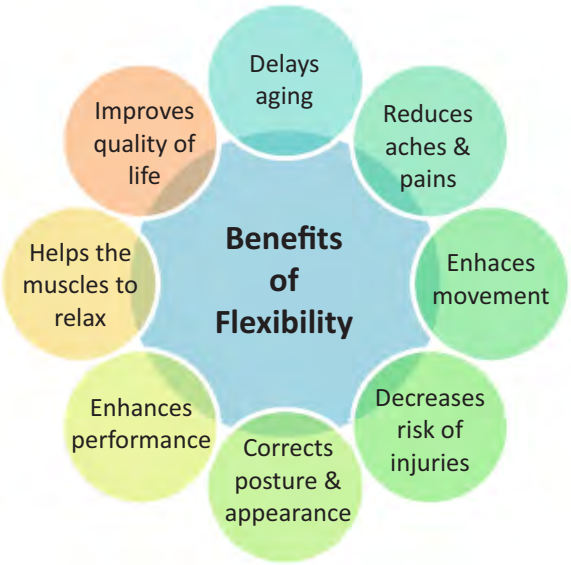


Fig.6.2.1 Benefits of Flexibility

Notes

Unit 6.3: Factors effecting Flexibility

Unit Objectives

At the end of this unit, the participant will be able to:

1. Understand the two phases in a fitness regime
2. State the factors that affect flexibility

6.3.1 Phases of Fitness Regime

There are two phases of the fitness regime where flexibility exercises are integrated.

Warm-ups: During this phase the movements are done to imitate the exercises that will be done during the workout. The aim of warm-ups is to increase the core temprature of the body. It alos helps in reducing the risk of injuries during work out.

Cool down: During this phase the muscles that have shortened during exercise have to be lenghthened. This is done by adding static stretches to restore and enhance the ROM of the muscles.

6.3.2 Factors that affect Flexibility

The factors that affect flexibility are:

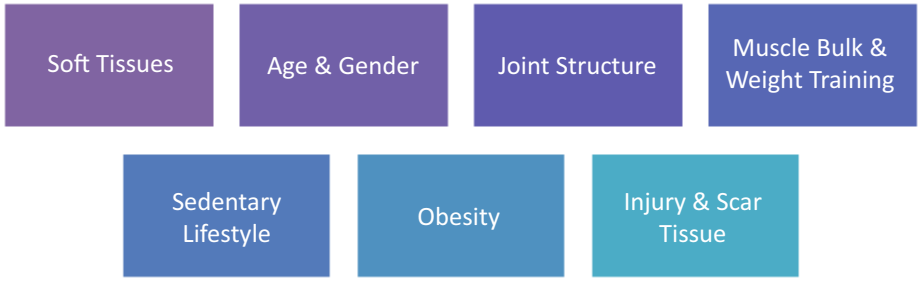


Fig. 6.3.2 Factors affecting Flexibility

6.3.2.1 Soft Tissues

The range of motions of joints varies from one joint to another. The ROM is dependent on:

- Joint structure
- Joint capsule
- Connective tissues

Connective Tissues: When the muscle elongates, the connective tissue surrounding it become taut. This happens because of the resistance offered by muscles. Inactive muscles or joints cause chemical changes in connective tissue. This restricts Flexibility.

Role of Tissues in Joint Stiffness

Name of Tissue	Percentage of Stiffness
Joint Capsule	47 %
Fascia of Muscles	41 %
Tendons	10 %
Skin	2 %

Elastin	Elastic Fibres	Collagen	Fibrous Connective Tissues	Ligaments
It is present in different concentrations	Present in the muscles	Represents 33% of the structural protein component in the body	It is like an elastic band present in the muscles	They do not have any elastic properties
Role : Determines the muscle extensibilty	Role: Conserves muscle tone during relaxation Enhances coordination during rhythmic movements Accomodates excessive tissue Returns tissues to their original length	Role: Allows the skin the flexibility it needs to stretch Provides strength and structure to the muscles for movement	Role: Increases the ability of the muscle to be lengthened with less resistance	Role: Increases in length with exposure to stretching

Viscocity: This is another property that affects soft tissues. Viscous means thick and when this thickness is added , it resists change. Likewise, when viscocity is reduced , the resistive force in the tissues allow for greater range of motion.

6.3.2.2 Age and Gender

With age a persons body deyhdrates and looses flexibility.The decrease in flexibility is also due to the fibrous tissues that replace the muscle fibres. This process is called fibrosis.

Advantages of execrcise for older people:

- Stretching stimulates the production and retention of lubricants
- Prevents the formation of adhesions
- Delays loss of flexibility

Note: Females tend to be more flexible than males.

6.3.2.3 Joint Structure

There are different types of joints in the human body. Some of these have a better range of motion than the others. Here are a few examples of how some of the joints move.

Ball and Socket Joint: This joint is found in the shoulder. It has the most ROM as it can move each one of its anatomical planes

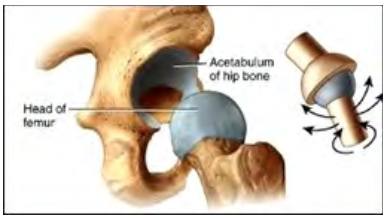


Fig. 6.3.2 (a) Ball and Socket Joint

Elliposodial Joint: This is the joint of the wrist. It can move along two planes, sagittal and frontal.

Fig. 6.3.2 (b) Elliposodial Joint

Hinge Joint: There are two hinge joints, one is at the ankle and the other at the knee. Both allow an ROM in the sagittal plane.

Fig. 6.3.2 (c) Hinge Joint

6.3.2.4 Muscle Bulk and Weight Training

Sometimes for people who are muscular it difficult to complete certain stretches such as an overhead tricep stretch. This is called hypertrophy and can affect ROM by obstructing the joint movement.

The muscles retain a “pump” and are shortened briefly. This happens when intense muscle exercise is not taken through its full ROM. This “pumped” muscle is full of lactic acid and other by-products. This happens because of the muscle has not been stretched post the exercise. It retains the decreased range of motion and causes post exercise soreness.

The best way to enhance promotion of muscular development is to add static stretches for the fatigued muscles.

Note: Strenous exercise often causes damage to the connective tissue of the muscle.

6.3.2.5 Sedentary Lifestyle

The human body is like any other machine. It goes into disuse and will malfunction if fitness is ignored. The body also gets accustomed to a limited ROM.

Disadvantages of a Sedentary Lifestyle:

- Muscles and tissues become less pliable
- Muscles and tissues shorten
- Muscles and tissues become weak
- Muscles and tissues are prone to injury

6.3.2.6 Obesity

A fat person generally tends to have excess body fat in and around joints and muscles. This acts like a mechanical block to the full ROM. This happens because the excess tissue acts like block, preventing joint motion.

6.3.2.7 Injury and Scar Tissue

Injury in the muscle and joints leads to:

- Decreased range of motion (due to pain)
- Decreased flexibility (due to time need for healing)
- Tightens and weakens muscles
- Tighter, weaker and less elastic tissue (due to the formation of scar tissue)

Notes

Unit 6.4: Physiology of Stretching

Unit Objectives

At the end of this unit, the participant will be able to:

1. Understand the physiology of stretching
2. Examine the role of proprioceptors in stretching

6.4.1 Stretching

Stretching the muscles is good for the muscles! These stretching are conducted deep inside muscle tissues and at points where the bones meet the muscles. The muscles benefit from force which helps them move the bones. This is done throught the shrinking and lengthening effect of the muscles.

6.4.2 Proprioceptors

Proprioceptors are nerve endings that convey all the information of the muscoskelatalsystem to the CNS. They are located in the nerve endings of the joints, muscles and tendons. The ones that relate to stretching are located in the tendons and the muscle fibres.

Function of Propriocepters

- They detect changes in the movement or position within in the morning.
- They detect the tension or force in the body.

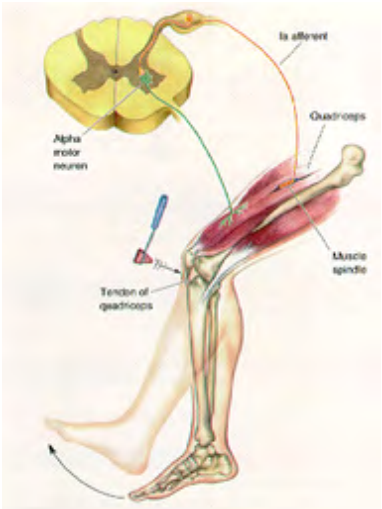


Fig. 6.4.1 Propriocepters

Muscle Spindles and Golgi Tendon Organ (GTO)

Stretch receptors or muscle spindles are the primary proprioceptors of the muscles.The basic role of the muscle spindle is to protect the body from injury and help tone the muscles. They are receptive to the change in the muscle length and the rate of change in muscle length. When these muscles contract they create tension on the tendons where the Golgi tendon organ is located.

The GTO or golgi tendon is another proprioceptor that is involved in the stretching exercises. It is located in the tendon near the end of the muscle fibre.The GTO is receptive to the change in tension and the rate of tension that is created by the muscle spindles. The muscle spindles stretches when the muscle stretch. The muscle sindle then records the change in length and sends a message to the spine.

Myotatic Reflex (Stretch Reflex)

Once the muscle spindle send a signal to the spine it activates the stretch reflex or the myotactic reflex. This reflex tries to resist the change in the muscle length by contracting the stretched uscle to contract. The more rapid the change in muscle length, the stronger the muscle contractions will be.

Autogenic Inhibition

When tension is created by the golgi tendon organ it exceeds a certain threshold . This triggers a lengthening reaction. This reaction prevents the muscles from contracting and causes them to relax. This is called autogenic inhibition. The lengthening reaction happens because of the signal given by the golgi tendon to the spinal cord. This signal is so powerful that it overcomes the signals of the muscle spindles that tell the muscle to contract.

Reciprocal Inhibition

Reciprocal inhibition is a neural factor that affects the muscle. The muscles always work in pairs. When one muscle contracts because of reciprocal inhibition, its opposing partner muscle relaxs to permit movement.

Example: While performing a bicep curl, the triceps relax to allow the bicep muscles to shorten.

Notes

Unit 6.5 Types of Stretching

Unit Objectives

At the end of this unit, the participant will be able to:

1. Classify the different type of stretching
2. Demonstrate the stretches

6.5.1 Types of Stretching

Every part of the body involves stretching. Stretches could be as simple as walking or as complicated as the dynamic stretches. Knowing the difference between each stretch is important for a person who is exercising. Stretches need to planned keeping the fitness level and exercise goals in mind.

Stretches are of two types:

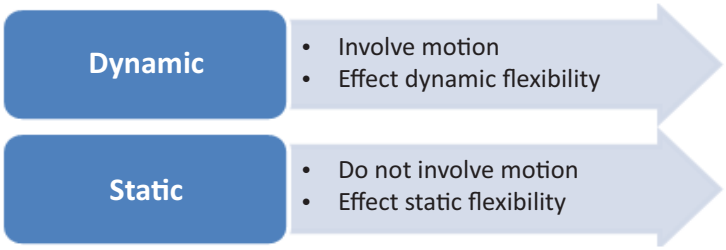


Fig. 6.5 Types of Stretches

6.5.2 Types of Stretching Exercises

Static Stretching
• The muscles or group of muscles are stretched to their fathest point. • The force of one limb pulling on another provides the stretching force.
Time: • Maintain the holding position for 15 – 30 seconds
How it works: • There is gradual loss of tension and muscle lengthening when a muscle is held and stretched at a constant length
Example: • Seated forward bend • Chest Stretch

Seated forward bend

Chest stretch

Active Stretching	 *Active Stretching*
• A person has to assume a position and hold it wothout any help. This is done by using the strength of the agonist muscles. • The tension created by an active stretch helps to relax the muscles being stretched by reciprocal inhibition.	
Time: • Maintain the holding position for 10 -15 seconds	
How it works: • It increases active flexibility and strengthens the agonisitc muscles	
Example: • Holding one arm behind to flex the bicep muscles • Standing upright and fully stretching the hamstrings	

Passive Stretching	 *Splits*
• A person has to assume a position and hold with the help of a equipment, partner or some other part of the body	
Time: • Maintain the holding position for 15 – 30 seconds	
How it works:	
Example: • Holding one arm behind to flex the bicep muscles	

Dynamic Stretching

- A person has to use sports specific movements to prepare the body for workouts.
- Here the emphasis is on movements of sports rather than specific muscles.
- It is not to be confused with ballistic stretching

Time:

- These exercise should be performed in sets of 8 -12 repetions

How it works:

- It improves dynamic flexibility
- It is a good warm –up for an active or aerobic workout

Example:

- Slow controlled leg swings
- Arm swings
- Torso twists
- Controlled leg swings

Slow controlled leg swings

Arm Swings

Torso twists

Leg swings

Active Isolated Stretching (AIS)	
• A person stretches the muscle passivley with the help of a trainer or a rope for 2 seconds. Then immediately returns to the starting position. This absorbs the natural ROM before the reflex action is activated. • AIS works on the principle of Reciprocal Inhibition. This means that the muscles on one side of a joint must relax in order for the opposing muscle group to contract.	 *Hamstring stretch*
Time: • These exercises are to be repeated 8-10 times by increasing the ROM by 6-10 degrees with each stretch.	
How it works: • It re-programs the mind and body to remember the new ROM with each repetition. • It enhances and retains the gains made in	
Example: • Hamstring stretch	

Ballistic Stretching	
• A person has to use the momentum of his /her moving body or limb. This is done in an attempt to force the muscles beyond their normal ROM.	 *Ballistic Stretching*
Time: • Maintain the holding position for 15 – 30 seconds	
How it works: • This is not a useful stretch as it can lead to injury • Reason: It does not allow muscles to relax and adjust in the stretched position	
Example: • Bouncing down repeatedly to touch your toes	

PNF Stretching

- It means ''Proprioceptive Neuromuscular Facilitation''.
- It is a technique that combines passive and isometric stretching.
- A persons muscle group is stretched and then contracted isometrically against resistance.
- Then it is passively stretched again which results in increased ROM.

Time:

- These exercises should be performed in sets of 2-5.
- Each stretch should be held for 30 seconds after the contracting phase.

How it works :

- The passive and isometric stretching helps in achieving maximum static flexibility

Example:

- Hamstring Stretch

Hamstring stretch

PNF Stretching – Guidelines

- A gap of 48 hours should be given between PNF stretching routines
- Only one exercise per muscle group should be performed per session
- This stretching should not be performed by a person below the age of 18 years
- If PNF stretchingis done as an independent exercise , then a complete warm uo and some dynamic stretches should be included in the beginning
- PNF should be avoidedbefore or on the morning of a sports competition

Upper Body Stretches

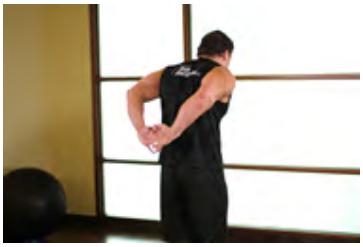
		
Neck Stretch Start	*Neck Stretch End*	*Anteria Delt Stretch*
		
Posteria – Medial Deltoid Stretch	*Biceps Stretch*	*Chest Stretch*
		
Oblique Stretch	*Forearm Extensor Stretch*	*Forearm Flexor Stretch*
		
Lower Back Stretch	*Upper Back Stretch*	*Partner Latissimus Dorsi Stretch*

Fig.6.5.2 (a) Upper Body Stretches

Lower Body Stretches

		
Calf Stretch End	*External Hip Rotator*	*Kneeling Quadricep Stretch*
		
Gluts Stretch	*Seated Hamstring Stretch*	*Seated Adducter Stretch*
		
Outer Thigh Stretch	*Abdominal Stretch*	*Shin Stretch*

Fig. 6.6.2 (b) Lower Body Stretches

Notes

Unit 6.6: Principles of Flexibility Development

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the principles of flexibility development
2. Design a flexibility plan
3. Design a strength training program

6.6.1 Flexibility Development

An ideal work out fitness plan will always incorporate stretching exercises. These help in producing beneficial changes in muscle and joint ROM.

The principles that need to be taken into consideration while developing an effective stretching program are:

- Progressive overload
- Specificity
- Reversibility
- Individual Differences
- Balance

6.6.2 Ideal Flexibility Plan:

Flexibility helps in sports, training and everyday life. However, the training for flexibility can be a bit complicated. It is important to plan the frequency, intensity and duration of flexibility exercises to get better results.

Given below is an ideal flexibility plan:

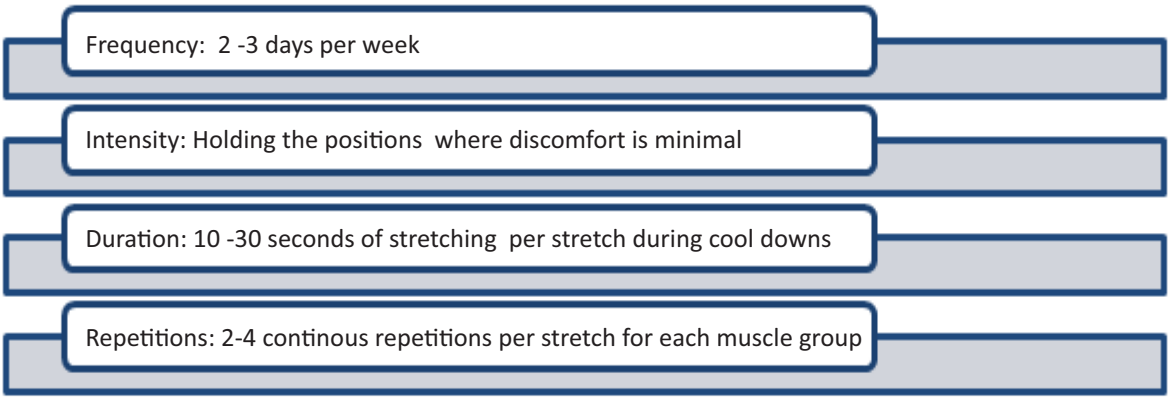


Fig.6.6.2 Ideal Flexibility Plan

6.6.3 Strength Training Program:

There are six steps involved in designing a strength-training program. Those are:

Fig.6.6.3 Strength Training Program

1. **Exercise Selection:**

   The goal is to select one exercise for each major muscle group, achieve muscular balance, prevent injury and increase efficiency of movement. Muscle groups of chief concern are:

   - Biceps/triceps
   - Anterior deltoid/posterior deltoid
   - Pectoralis/rhomboid, trapezius
   - Rectus abdominus/erector spinae
   - Iliopsoas/gluteus
   - Quadriceps/hamstrings
   - Anterior tibialis/gastrocnemius, soleus

2. **Exercise Sequence:**

   Proceed from the larger muscle groups of the legs to the smaller muscle groups of the torso, arms and neck. This allows the performance of the most demanding exercises with the least fatigue.

3. **Exercise Speed:**

   A fast pace places a high stress on muscles and connective tissue. A slower pace requires a more even application of muscle force throughout the ROM utilizing less momentum and less internal muscle friction. Use control with a recommended speed of 1-2 seconds for each lift (concentric), and 3-4 seconds for each lowering movement (eccentric).

   Reasons to Control Speed:

   - Consistent application of force
   - Increased total muscle tension and total force produced
   - Greater muscle fiber activation. Greater muscle power potential. Less tissue trauma and injury

4. **Exercise Sets:**

   Exercise sets vary from single to multiple sets with one to three minutes rest between sets.

5. **Exercise Resistance and Repetitions:**

   Training above 85% of 1 RM increases risk of injury, training below 65% decreases the strength stimulus. Recommended for safe and productive training; 8-12 Reps with 70% to 80% 1 RM. Beginning intensities should be 12-20 repetitions with less than 70% of 1 RM.

6. **Exercise Range**

   Use full range of motion.

7. **Exercise Progression**

   An increase in resistance is usually accompanied with a temporary decrease in the number of repetitions.

Exercise Frequency

Muscle rebuilding usually requires 48 hours and workouts should be scheduled every other day. Avoid training the same muscle group on consecutive days.

Exercise Recovery Time				
Load	**Results**	**Rep Range**	**# of sets**	**Rest between sets**
Light	Muscular Endurance	12-20	1-3	20-30 seconds
Moderate	Hypertrophy/Strength	8-12	1-6	30-120 seconds
Heavy	Max Strength/Power	1-8	1-8	2-5 minutes

Health and fitness gains may be achieved with just two sessions per week with at least 10 exercises that target all major muscle groups, use at least one set of 8-12 reps completed to fatigue. Goals can be optimized by using active recovery between sets, (i.e. stretching or working another body pad.

Functional Training:

Functional training requires balance and muscular stability. In the case of:

- Closed-chain movements - the end of the chain is a fixed object such as the floor and approximate human movement (i.e. squats, lunges).
- Open-chain isolate the knee to work the quadriceps (i.e. leg extension).

Bodybuilding:

- Body building centres around balanced muscular size with a manipulation of sets and reps with
- Structured rest periods. (See Progressive Fitness Personal Trainer Study Guide).

Competitive Athletes:

Competitive Athletes utilizes sport specific training to preserve movement with speed and load. Training often incorporates plyometric and skill practice.

Order of Muscle Fiber Recruitment:

The more fatigue-resistant slow-twitch fibers are recruited first. As resistive forces increase, the less fatigue-resistant fast-twitch fibers are recruited.

By properly designing a strength training program a client can achieve optimum results. This is accomplished by:

- Designing programs with specific goals
- Fitting all systems into the specificity chart
- Encouraging consistent, regular and varied efforts
- Teaching proper biomechanics
- Allowing for recovery
- Keeping accurate records
- Update all physician information

Summary

- A flexible body is required to do everyday routine work.
- Flexibility helps correct the imbalance in the muscle.
- It helps to improve the extensibility of the soft tissues which in turn increase joint range of motion.
- Flexibility reduces greatly with age. This also happens to inactive and sluggish life style.
- During his/her lifetime a person creates certain postures. He /she may develop certain posture habits unknowingly that can lead to reduced mobility of joints.
- Flexibility leads to better performance in aerobic training and most importantly it reduces the chance of injuries.

Notes

Exercise

Choose the correct answer:

Q1. **The purpose of warm-up is to increase the core _____in the body.**
a. Muscles
b. Temperature
c. Energy
d. Function

Q2. **ROM means _____.**
a. Range of motion
b. Range of matter
c. Range of meter
d. Range of mind

Q3. **The _____ detect changes in movement or position.**
a. Protectors
b. Protractors
c. Proprioceptors
d. Preceptors

Q4. **The _____muscles are used in active stretching.**
a. Agonist
b. Cardiac
c. Antagonist
d. Smooth

Q5. **_____Stretching is not considered useful and can lead to injury.**
a. PNF
b. Ballistic
c. Static
d. Active

Answer the following questions:

1. State the different types of stretching.

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____

2. State any three factors that affect flexibility.

a. _____
b. _____
c. _____

3. State any three benefits of flexibility.

a. _____
b. _____
c. _____

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7. Maintain Health And Safety Of Workplace

Unit 7.1 - First aid

Unit 7.2 - CPR

(BWS/N9002)

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. Demonstrate how to give first aid for injuries
2. Demonstrate how to give CPR (Cardio –Pulmonary Resuscitation)

UNIT 7.1: First Aid

Learning

At the end of this unit, the participant will be able to:

1. Demonstrate the procedure to give first aid for fainting
2. Demonstrate the procedure to give first aid for heat cramps
3. Demonstrate the procedure to give first aid for heat exhaustion and heat stroke
4. Demonstrate the procedure to give first aid for asthma
5. Demonstrate the procedure to give first aid for choking
6. Demonstrate the procedure to give first aid for soft tissue injuries

7.1.1 Fainting

A brief loss of consciousness that is caused by decreased blood flow to the brain is called fainting. It is also called Syncope. The different conditions that can cause fainting are:

- Irregular heartbeats
- Seizures
- Low blood sugar (hypoglycaemia)
- Anaemia
- Blood pressure
- Sudden postural changes

Fig.7.1.1 Fainting

First aid Guidelines:

1. **Position the person on his/her back:**
   - If the person is breathing then raise the person's legs above heart level (about 12 inches/ 30 centimetres) to restore blood.
   - Loosen belts, collars or other restrictive clothing
2. **Check the person's airway to make sure it is clear:**
   - Check for vomit
3. **Check for signs of breathing, coughing or movement:**
   - If these signs are not visible, begin CPR immediately. Continue giving CPR till help arrives.
   - Call for an ambulance immediately.
4. **Check for injuries**
   - If the person has fallen because of fainting, then he may be injured.
   - Check for cuts, bumps or bruises. Treat them appropriately.
   - If there is any bleeding, control it with direct pressure.

7.1.2 Heat Cramps

Heat cramps happen during exercise or working in a hot environment. These are painful and occur in the muscles like:

- Calves
- Thighs
- Shoulders

A heat cramp can occur in a person when he/she begins a new activity. The body is not used to the activity especially if the person is working / exercising in a hot and humid climate. Heat cramps also happen because of electrolyte imbalance. This happens when the level of minerals like sodium, potassium, calcium and magnesium decreases. This in turn causes the cell size to decrease which affects cell metabolism.

Fig. 7.1.2 Heat Cramps

First aid Guidelines:

- Rest and apply direct pressure to the cramp to release it.
- Gently massage the area.
- Replace the lost fluids and electrolytes.
- Do passive stretching of the affected area.

7.1.3 Heat Exhaustion and Heat Stroke

Heat Exhaustion: Exercise causes stress on the body. When a person exercises his/her body temperature increases. Blood rushes to the surface of the skin and the pores are opened up for the body heat to escape through sweating. Thus, the body temperature is maintained through the evaporation of sweat.

A person who has suffered from heat exhaustion tends to lose body fluids and salts. It also leads to increased core body temperature. This happens when the body is exposed to high temperature for a long time.

Fig.7.1.3 Heat Exhaustion

First aid Guidelines:

- Get out of the heat immediately
- Rest in a cool place/ room
- Remove any tight clothing
- Take a cool shower/ bath/ sponge bath
- Use other methods to cool the body, like fans or ice towels
- If the above measures fail to give relief within 30 minutes, then seek medical advice immediately as heat exhaustion can lead to heat stroke

Heat Stoke: This kind of stroke is life threatening. It can become fatal causing brain damage and can affect other internal organs. Heat stroke occurs due to prolonged exposure to high temperature combined with dehydration. This leads to a failure of body's temperature control system. Heat strokes mostly occur as a progression from heat related illnesses such as heat cramps, fainting and heat exhaustion.

The medical definition of heat stroke is a core body temperature greater than 105 degrees Fahrenheit, with complications involving the central nervous system that occur after exposure to high temperatures.

First aid Guidelines:

- Get out of the heat immediately
- Rest in a cool place/room
- Drink plenty of fluids with electrolytes to restore the hydration levels of the body
- Remove tight clothing.
- Give the person a cool shower or a cool tub bath.
- Place ice packs or cold wet towels on the head, neck armpit back and the groin area

Signs or Symptoms of Heat Exhaustion or Stroke

Heat Exhaustion	Heat Stroke
Dizziness	Dizziness or a light headache
Fainting	No sweating despite heat
Fatigue	Red, hot and dry skin
Headache	Weakness in the muscles/ cramps
Muscle cramps	Nausea and vomiting
Nausea	Throbbing headaches
Pale skin	Rapid heart beat
Confusion	Confusion or disorientation
Profuse sweating	Seizures
Rapid heart beat	Unconsciousness
	Coma (worst case scenario)

7.1.4 Asthma

In cases of asthma, a person is unable to breathe because of inflammation of the air passages. The airways become narrow because of a muscle spasm, swelling and increased production of mucous. This also causes a wheeze to be heard.

The common factors that can trigger an asthma attack are:

- Chest infection
- Pollen
- Dust
- Fur
- Smoke
- Cold air
- Exercise

Fig.7.1.4 (a) Asthma

Symptoms and Signs of Asthma

- The patient will be wheezing
- The patient will cough continuously
- The patients skin will become pale, the lips and fingertips will turn blue

First-aid Guidelines:

1. Make the patient sit in an upright position, leaning forward with arms resting on the table.
2. Ask the patient to take any 'reliever' medicine that they may have. Ask the patient to take 6 puffs of the medication. Repeat the dose after 6 minutes if there is no improvement.
3. Call an ambulance immediately.

Fig. 7.1.4 (b) A person using asthma pump

7.1.4 Asthma

Choking happens when a person is unable to breathe or speak because of an obstruction in the throat or windpipe. This blockage can be due to food, trauma or internal swelling because of an allergic reaction.

Choking can be sudden if food or some foreign body is inhaled; however it is gradual in case of internal swelling.

If the airway is partially obstructed, then the patient will be able to breathe with difficulty. This will be accompanied by coughing and a whistling sound. If this happens, then one should avoid giving back blows to the patient as this may cause the object that is stuck to move and cause a complete blockage.

Symptoms and Signs of Choking

- Inability to cough, breathe or speak with no air movement
- The face will become grey in colour and the lips will turn blue due to lack of oxygen
- The patient will clutch at the throat with both hands. This is the universal sign of choking

First-aid Guidelines:

First-aid Type 1:

1. Ask the patient to stand or sit and lean forward a bit.
2. Then using the using the heel of one hand, give the back blows between the patients shoulder blades.
3. For an adult or child give up to 5 back blows.
4. If the choking does not stop give up to 5 chest thrusts.

First-aid Type 2:

1. Make the adult or child, sit or stand. Wrap both arms around the patient at chest level.
2. Place one fist with the thumb side against the middle of the breastbone.
3. Hold that fist with your other hand and give up to 5, separate, inward and upward thrusts Continue the thrusts until the obstruction is dislodged

Fig. 7.1.5 Choking

Note: Call an ambulance immediately while giving the first aid.

7.1.6 Soft Tissue Injuries

Soft injuries are injuries that occur in the body tissues. The following injuries can be classified as soft tissue injuries:

Sprains: This is an injury that occurs in ligament s and other soft tissues around a joint. Example: ankle or wrist

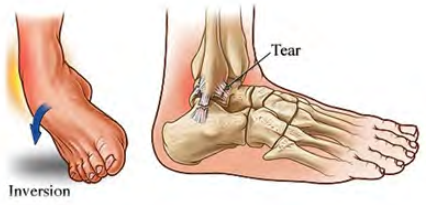

Fig. 7.1.6 (a) Soft Tissue Injuries

Strains: This injury involves a torn or overstretched muscle or tendons. This occurs away from a joint. Example: calf, thigh or lower back

Fig. 7.1.6 (b) Strains

Bruises: This injury occurs in the skin and the surrounding tissues. This happens because of a blow or some other forces that break the blood vessel close to the surface of the body. A bruise can be seen in a sprain as well as a strain.

Fig. 7.1.6 (c) Bruise

Symptoms and Signs of Soft Tissue Injuries

- Severe pain at the injury site, this happens in a sprain or strain
- The injured area will lose power, especially in a sprained joint
- There will be swelling in the injured area

First-aid Guidelines:

Apply the RICE technique. Rest, Ice, Compression and Elevation

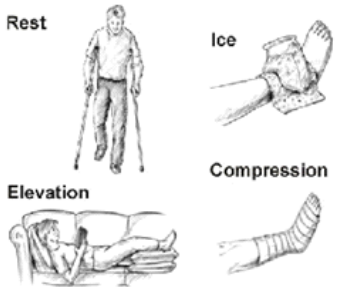

Fig.7.1.6 (d) RICE Technique

Rest: Try and rest the injured tissue as much as possible.

Ice: An icepack will help to reduce pain. Apply the ice pack for 10 -20 minutes at a time. Repeat, if the pain persists. Avoid applying ice for a long period. Always wrap the ice in a cloth. Do not apply directly.

Compression: Tie a crape bandage to compress the injured tissue.

Elevation: Keep the injured area in a elevated position for at least 24 -48 hours.

Notes

Unit 7.2 – CPR

Unit Objectives

At the end of this unit, you will be able to:

1. Demonstrate how to revive a person with CPR technique

7.2.1 What is CPR?

The full form of CPR is Cardio Pulmonary Resuscitation. It is a manual method of pumping blood around a person`s body if the heart has stopped functioning (cardiac arrest). CPR is designed to keep the blood pumping so that the heart and brain cells do not die due to lack of oxygen. IT IS NOT DESIGNED TO RESTART THE HEART. CPR is needed when the patient becomes unresponsive or is not breathing normally.

CPR is not difficult to administer. It is very important to give CPR to anyone who has suffered from a cardiac arrest for the person to survive.

The DRSABCD action plan is applied in a situation where a person has suffered cardiac arrest. The plan is as follows:

D Danger: Check for danger and make the area safe for:

1. The patient
2. Bystander
3. You

R – Response: Check for response

1. Ask the patient a simple question
2. Grasp/ squeeze

S – Send for Help: Call for an ambulance ASAP (As Soon As Possible)

A - Airway: Open the airway

1. Tilt the head back
2. Lift the chin

B – Breathing: Check for breathing

1. Look for chest movements (up and down)
2. Listen by putting your ear next to the mouth and nose of the patient
3. Feel for breathing by putting your hand on the lower part of the patient's chest
4. If the person is unconscious, then turn them onto their side, make sure that you keep their head, neck and spine in alignment.

C – CPR: The procedure:

1. Make sure that the patient is flat on their back.
2. Place the heel of one hand in the centre of the patient's chest and your other hand on top
3. Press down firmly and smoothly 30 times (compressing to one third of their chest)
4. Give two breaths; tilt the head back gently by lifting the patients chin to get the breath in
5. Close the patient's nostrils

6. Place your open mouth into the patient`s open mouth and blow firmly into his/her mouth
7. Do this for 30 compressions and two breaths at the speed of approximately five repetitions in 2mins until:
    - The ambulance arrives
    - A trained person arrives
    - The patient responds

Note: Chest compressions are the most important part of CPR. If for some reason breathes cannot be given to a patient, then at least chest compressions must be performed.

D – Defibrillator: AED or Automated Electronic Defibrillator is a machine that delivers an electrical shock to cancel any irregular heart beat. This is done to get the normal heat beating to re-start.

Summary

- As a fitness trainer it is important to know how to give first aid for injuries or illnesses that may occur in the gym.
- Every injury or illness is different and should be handled differently.
- Guidelines for each type of injury should be followed strictly.
- First aid is a bridge between a life and death situation and so should never be ignored.
- Always remember to call for professional help if the situation is out of your control.

Notes

Exercise

State whether the following statements are true or false.

Q1. **A brief loss of consciousness that is caused by decreased blood flow to the brain is known as a seizure.**
a. True
b. False

Q2. **Heat cramps happen during exercise or working in a hot environment.**
a. True
b. False

Q3. **A person can get heat exhaustion because of heat stroke.**
a. True
b. False

Q4. **A person can get asthma due to pollen and dust in the air.**
a. True
b. False

Q5. **The patient will clutch at his head with both hands. This is the universal sign of choking.**
a. True
b. False

Q6. **Sprain is an injury that occurs in ligaments and other soft tissues around a joint.**
a. True
b. False

Q7. **RISE is the technique applied to help in soft tissue injuries.**
a. True
b. False

Q8. **CPR is designed to restart the heart.**
a. True
b. False

The jumbled procedure for the CPR procedure is given below. Number the correct procedure from (1 to 7).

____ Press down firmly and smoothly 30 times (compressing to one third of their chest)

____ Give two breaths; tilt the head back gently by lifting the patients chin to get the breath in

____ Close the patient's nostrils

____ Place the heel of one hand in the centre of the patient's chest and your other hand on top

____ Do this for 30 compressions and two breaths at the speed of approximately five repetitions in 2 mins until:

- Ambulance arrives
- Trained person arrives
- Patient responds

____ Make sure that the patient is flat on their back.

____ Place your open mouth into the patient's open mouth and blow firmly into his/her mouth

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8. Create A Positive Impression At The Workplace

Unit 8.1 – Introduction

Unit 8.2 – Providing a caring environment – Creating right first impression

Unit 8.3 – Personal grooming in accordance with organization standard

Unit 8.4 – Communication Techniques

Unit 8.5 – Instruction Sequence – Tell, Show, Do – Providing Feedback

Unit 8.6 – Professional Boundaries

Unit 8.7 – Stages of Motor Learning

(BWS/N9003)

Key Learning Outcomes

At the end of this module, the participant will be able to:

1. State the tips needed to make a good impression at work
2. State the stages of a client–trainer relationship
3. State the dos and don'ts of grooming
4. Define and state the importance and benefits of communication
5. State the various techniques of communication
6. Demonstrate the instruction sequence for an exercise and learn to give feedback
7. Understand and state the guidelines to maintain a professional relationship
8. Demonstrate the approach to training

Unit 8.1: Introduction

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the tips needed to make a good impression at work

8.1.1 Tips to make a good impression at work

Everyone wants to create a good impression at work. As a professional gym instructor people should notice you but for the right reasons! You can create a positive impression by being responsible, proactive, dress well and interact discreetly with clients. This will help you to get promotions and a raise in your salary too!

A few ways in which you can make a good impression at work are:

- **Restrictti Cellti Phoneti Usage:** You should avoid taking the cell phone to the workout area. Always keep the cell phone on silent mode. Do not talk on the cell phone while taking an exercise session with clients.
- **AdmittiYourtiMistakes:ti**Everyone makes mistakes at work. No one is perfect; however do not blame others for your mistakes. Do not ignore your mistakes, instead admit your mistake, apologise and find a way to fix your mistake.
- **TaketiLeavetiiftiyoutiaretiUnwell:ti**At the gym, you are promoting health and fitness. If you are not well, call your seniors and inform them of your condition. Stay at home and rest as certain illnesses are contagious and can spread germs. Some of the diseases that can spread in the gym are:
  1. Flu: If you suddenly get body ache, fever and cold, then you are suffering from flu.
  2. Sore Throat: This means that your throat hurts a bit. If it is severe then you may feel like you are swallowing a sharp object all the time. Strep throat is a condition where you will suffer from fever, swollen glands and severe throat pain. Consult a doctor immediately as you may need to take a dose of antibiotics.
  3. Fever: If you have fever then you certainly have some kind of infection. This means that the body is fighting the infection. This infection may or may not be contagious.
  4. Rash: Avoid contact with people if you have a rash. Come to work only if the doctor says that the rash is not contagious.
  5. Common Cold: If you have uncontrollable cough, stay at home. Cold spreads very quickly, especially in a closed environment like the gym.
- **Beti Civilti withti yourti Colleagues:** Respect others and others will respect you. Do not offend people by your behaviour. Always be polite. Use these words generously – Please, Thank you & Sorry.

A few things you should avoid:

- Do not talk loudly in the phone
- Do not gossip
- Do not litter and leave waste bags and paper cups, etc. in the common areas like the cafeteria
- Don't take food that belongs to others
- Don't be late for work
- Don't ask someone to lie for you
- Don't take credit for someone else`s work
- Don't complain all the time

Notes

Unit 8.2: Providing a Caring Environment – Creating Right First Impression

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the stages of a client–trainer relationship

8.2.1 Stages of Client – Trainer Relationship

Gym Assistant is a facilitator and teacher to the client. The goal is to achieve a certain objective in order to improve the client's physical fitness levels. As an assistant you have to first establish a relationship with the client.

The four stages are:

Fig. 8.2.1 Stages of Client-Trainer Relationship

Rapport Stage: This stage begins when the client and trainer meet for the first time. Rapport building involves a certain level of mutual trust and understanding. For this the trainer must understand the client and at the same time the client must understand what the trainer wants. The trainer should observe and make note of the client's appearance, behaviour, mood and attitude, speech, perceptions, memory, attention span and exercise IQ. These observations made during the first meeting will make it easier to establish rapport. The meeting should be held in a quiet place and not the gym floor or common areas. This will help as there will be fewer distractions during the one to one conversation.

There are five attributes needed to build rapport:

- Be genuine
- Accept what the client says
- Show a caring attitude
- Be respectful
- Be empathetic towards the client's needs

During the first interview the trainer should:

- Talk to the client in a general fashion to make him/her comfortable
- Listen to the client and let them do the talking. The trainer should ask the client to discuss their fitness needs.

This first talk/ interview will serve as a precursor to the next stage i.e. Investigation Stage. The first meeting will also serve to do needs analysis or understand the client's needs. This is important as setting fitness goals and designing the fitness program will be based on the needs analysis.

Investigation Stage: The main aim this stage is to collect information about the client's present fitness level, personal goals and physical limitations. The objective of the investigation stage is to have a conversation with the client to determine the degree of the client's medical limitations so as to tailor the workouts accordingly. The conversation should revolve around the following:

- Type of activities, intensity levels, duration, frequency
- Evaluation of progress
- Vital signs (Who is to take them? When? What signs? When should they be taken?)
- Medications (i.e. their effects? modified usage with exercise?)

The first investigation is a simple questionnaire of seven questions has been developed. This is called the PAR–Q test (Physical Activity Readiness Questionnaire) these are questions which a client needs to answer before starting any form of exercise at the gym.

The PAR-Q Questionnaire - Answer yes or no to the following questions:

1. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?
2. Do you feel pain in your chest when you do physical activity?
3. In the past month, have you had chest pain when you were not doing physical activity?
4. Do you lose your balance because of dizziness or do you ever lose consciousness?
5. Do you have a bone or joint problem that could be made worse by a change in your physical activity?
6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
7. Do you know of any other reason why you should not do physical activity?

The second form of investigation is a fitness assessment test. This involves tests for five areas of physical fitness:

- Cardiovascular endurance
- Muscular strength
- Muscular endurance
- Flexibility and body composition

These tests have standardized norms and generally require simple equipment. This assessment acts as a tool to promote program adherence for a client when comparing beginning baselines with their training results in future when improvements are observed.

Planning Stage

In this stage the trainer can design an exercise plan based on the results of the inves ga on stage. As a trainer you will need to design a program that the client will enjoy and will also take care of the client's fitness goals. Discuss every aspect of the fitness program with the client as the feel more involved thus promo ng better adherence.

The trainer and client begin the program by setting goals in the planning stage. These are set as per the client's want/needs, health and fitness assessment. There are three types of fitness goals:

1. **Physiological Goals** – These include cardiovascular endurance, muscular strength, muscular endurance, flexibility and body composition
2. **Cosmetic Goals** –These include e-proportioning or re-shaping the body i.e increase in muscle size or mass or loss of body fat
3. **Performance Goals** - recreational or sports specific

Some of the questions that should be asked while designing the program are:

- *What is the type of exercises that you generally like to do?*
- *Which type of exercise you dislike?*
- *Would you like to do a planned workout?*
- *How much time can you spend per week on your workout sessions?*
- *Have you used any gym equipment during exercise?*

Action Stage

Now that the clients fitness goals and exercise routine has been planned, it is time for the actual training to begin. There are three primary stages to learning a new skill.

- Cognitive (What to do?) – Making the client understand a particular exercise by showing them the muscles that will be used and then demonstrating how
- Affective (Why to do) – Tell the client how the muscles will become firm and shapely.
- Motor (How to do?) – Ask the client to perform the exercise that you just demonstrated.

Notes

Unit 8.3: Personal Grooming in Accordance with Organization Standard

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the dos and don'ts of grooming
2. Understand how to keep your uniform clean

8.3.1 General Grooming

How you dress and what you wear defines your looks and the impression that you create on people when they look at you. The gym or fitness training institute that you work for will want you to look neat and well dressed at all times. This will be important for them and their image as you will represent them. Most gyms have a basic uniform of T-Shirt, Track Bottoms and sports shoes for their employees. These are uniforms with the logo of the fitness centre. It also helps in differentiating the staff from the clients.

As a Gym Assistant, you have to understand the importance of and need for proper grooming and hygiene. The way you dress and behave will create an amicable environment in the gym.

Grooming Tips for Men		
Hair	**Nail and Teeth**	**Skin**
• Should be neatly cut • Should not extend beyond the collar line of the T-shirt • Long hair should be tied in a pony tail • Shampoo your hair frequently • Do not keep it oily	• Keep the nails short and well-trimmed • Brush your teeth twice a day • Use mouth wash to avoid bad breath	• Take a bath daily • Use a deodorant to avoid body odour • Wash your face frequently to look fresh

Grooming Tips for Women		
Hair	**Nail and Teeth**	**Skin**
• Long hair should be tied in a pony tail or a bun • Try and wear minimum hair accessories • Style your hair to suit your face	• Keep your nails short, well shaped and manicured • Avoid wearing bright or dark shades of nail polish • Nail polish should not be chipped • Brush your teeth twice a day • Use mouth wash to avoid bad breath	• Take a bath daily • Use a deodorant to avoid body odour • Wash your face frequently to look fresh • Avoid heavy makeup – clean and fresh face gives a healthy look at the gym

8.3.2 Don'ts for Good Grooming and Hygiene Habits

- Make sure that the shoelaces are tied and the socks are clean. Wear fresh socks every day.
- If you smoke then make sure there are no stains of nicotine on your fingers and teeth, avoid 'tobacco breath' by using a mouthwash before coming to the gym floor
- Do not chew pan and gutkha
- Do not pick your teeth, nose or ears in public
- Do not sneeze or your yawn with your mouth wide open, cover your mouth while yawning and sneezing
- Do not make loud belching sounds after eating
- Do not arrange your clothes and hair on the gym floor, use the washroom or changing room
- Do not eat with your mouth open
- Do not make noise while chewing food
- Polishing self-presentation skills

8.3.3 Uniform Upkeep:

- Make sure your uniform is neat, pressed and crumple free
- Make sure that the uniform that you wear is not torn
- Always wear your nametag

Notes

Unit 8.4: Communication Techniques

Unit Objectives

At the end of this unit, the participant will be able to:

1. Define communication
2. State the importance of communication
3. State the benefits of communication
4. State the various techniques of communication

8.4.1 Definition of Communication

Communication is not just talking to someone, it also involves writing, using sounds and gestures.

One can communicate in two ways:

- Directly: By talking
- Indirectly: By using sounds and gestures

As per the Miriam Webster dictionary the definition of communication is as follows:

1. The process of expressing, exchanging or conveying information; for example by means of speaking, writing, gesturing.
2. A message containing information such as statements, news, announcements and reports.
3. The act of conveying information and ideas.
4. The act of expressing thoughts, feelings and motivations.

8.4.2 What is Effective Communication?

Communication involves a speaker and a listener. A person can communicate well if his/her message has been understood clearly. Mistakes and misunderstandings may occur if a message is not transmitted clearly.

The best ways to communicate effectively are:

- Tell the person clearly
- Help the person to understand what you have said
- Describe the task or work in detail
- Explain the task or work to be done

8.4.3 Importance of Effective Communication

A person will always be successful if he communicates well. A person who can effectively convey his ideas and message will make fewer mistakes. This will also avoid confrontations and unnecessary misunderstandings.

Good Communication involves:

- Coordination
- Information
- Confirmation
- Timelines
- Accuracy

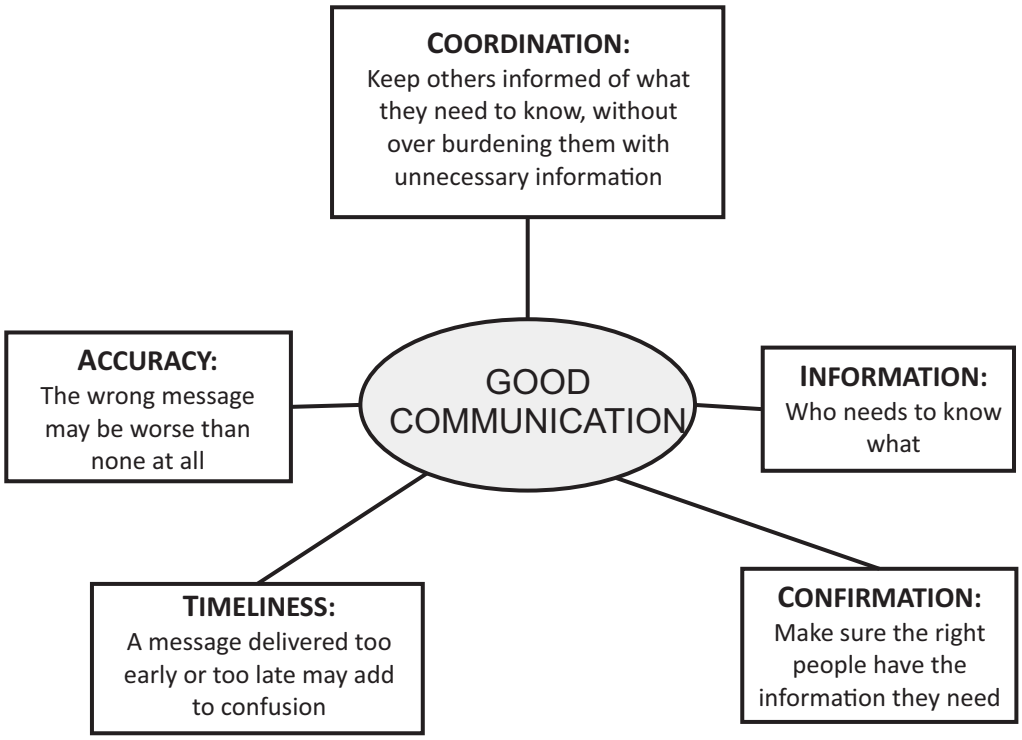

Fig.8.4.1 Features of Communication

8.4.4 Benefits of Effective Communication

If you communicate well then you will be able to solve a problem easily. You will be a better decision maker. Good communication will always keep your workflow going. Good communication will enhance your professional image and build a strong relationship between you and your client.

8.4.5 Techniques of Communication:

Some of the ways in which you can communicate are listed below. There is no hard or fast rule to communicate. You should be certain that what you want to communicate has been received well by the client.

- **Emulate your Client:** As a Gym Assistant, you must try and establish comfort and trust by in your clients by listening on their level. To do this, you must match their energy level conversation style, expression, body and mood.
- **Be a flexible Listener:** Some people always want to speak all the time. This means that they do not have the skill to listen to others. This also means that the conversation becomes one sided. Being a flexible listener will come in handy as a gym trainer, as it will allow you to know the right time to face delicate subjects during your talk with the client and when to avoid them.

- **Requestti Feedback:** Always confirm with the clients that your message (whether spoken or written) has been received. This is done to avoid misunderstandings. As a Gym Assistant, you can do this by asking the client to summarize an instruc on that you have given him to perform a certain exercise. If you do this, you will involve and make your listeners feel valued.
- **Cultivateti Curiosity:** As a Gym Assistant, your willingness to learn more about your clients will help develop a great bond. Try and develop a natural interest in people around you and listen to them with interest. This will help to build mutual trust and respect.
- **Suspendti Yourti Ego:** In a conversa on one person speaks and the other listens. Then the other person speaks and the first one should listen. Many mes one person will try to talk about an exci ng story of their own life. Therefore, many conversa ons are of people moving from one subject to another, without ever getting into great detail. The selfishness of each person then does not allow for a good conversa on to happen. As a trainer you should allow people to talk and tell their stories. You will have to show your clients that you are genuinely interested in their talk to connect and gain their trust.
- **Stayti Positive:** Always maintain a posi ve attitude. A posi ve attitude will set a stage for valuable conversa ons. Your clients will become defensive if you are harsh and nega ve with them.
- **Beti Enthusiasti c:** Joyfulness and laughter is always attrac ve. As a Gym Assistant, use this tool to communicate effec vely with your clients.

Notes

Unit 8.5: Instruction Sequence – Tell, Show, Do – Providing Feedback

Unit Objectives

At the end of this unit, the participant will be able to:

1. Demonstrate the instruction sequence for an exercise
2. Demonstrate how to give feedback to clients at the gym

8.5.1 Instruction Sequence – Tell, Show, Do

One of the most common approach for teaching/training is "Tell, Show, Do"

Tell Stage:

In this stage, tell the participants how you want them to perform the exercise. (i.e., verbal cues).

- Start with postural and stabilizer musculature cues (For example: eyes look forward, chest up, abdominals engaged).
- Follow with specific muscle group instruction (For example: contract the shoulder to bring the arm out to the side).

Show Stage:

In this stage, show the participants the correct method of performing the exercise.

- Demonstrate the exercise with proper form.
- Show the exercise that may be done at the same time as the verbal cueing (i.e., telling).

Do Stage:

In this stage, let the participants do the exercise.

- Initially, participants new to exercise should perform muscular strength and endurance exercises with little or no resistance.
- While the class is performing the exercise, the instructor gives and receives feedback.

This approach allows the instructor to provide participants with an auditory, visual, and kinesthetic learning experience.

8.5.2 Providing Feedback

As a Gym Assistant, it is essential for you to identify mistakes and errors in a clients exercise while he/she is performing. If you provide them with the correct feedback or correctional information on time it will help them to speed up their exercise routine.

Reasons to Provide Feedback are:

- To motivate the client
- To boost good performance
- To discourage poor performance
- To accelerate better performance

Tips to give Feedback:

- Use the technique of positive-negative- positive statements. Here, you first tell the client what went well during the exercise, then tell him/her what went wrong and then end with a positive statement that will motivate the client to do better in the next set.
- Justify your feedback by listing the points where the client can improve. Analyse the points in such a way that the client is happy to correct the errors.
- Show videos of similar exercises to the client and ask them to observe only certain steps where they have gone wrong.
- Always be positive. Your clients are not children. Do not reprimand or punish them.

Notes

Unit 8.6 – Professional Boundaries

Unit Objectives

At the end of this unit, you will be able to:

1. Understand how to maintain a boundary with clients while being professional
2. State the guidelines to maintain a professional relationship

8.6.1: How to Maintain a boundary with clients while being professional

A close bond will be formed when you and your client interact in the gym for a long time. These bonds are important for the clients to achieve their fitness goals, it is also important to remember that a line or a boundary should be maintained between you and your client.

As a Gym Assistant, you will need to touch your clients in order to help them with a certain exercise. To avoid any misunderstanding with a client, you should always explain why you need to touch them. Always ask permission before doing so.

8.6.2: Guidelines to Maintain a Professional Relationship:

- As an assistant and wellness professional, it is your responsibility to remind clients that you are a health professional. Position yourself as a professional and not a buddy.
- Try not to be alone with your client in the gym.
- Do not contact the clients outside the gym hours.
- Do not socialise with your clients after gym hours.
- Clients may want to talk about their personal lives. In this case, do not ask questions and lead the conversation. Just be a good listener and respond with phrases like, “I am so sorry to hear that” or “Wow, that must have been tough!” rather than asking additional questions. If the client talks about something that is beyond your purview ask them to speak to a counsellor.
- Do not discuss your personal life with the clients.
- If you are using social media for communication, create a professional account to offer fitness related advice. Do not add clients to your list of friends on Facebook etc.

Notes

Unit 8.7 – Stages of Motor Learning

Unit Objectives

At the end of this unit, the participant will be able to:

1. State the three stages of learning
2. Demonstrate the approach to training

When a person learns a new skill, he goes through three stages of learning. As an assistant, you should understand these stages as it will help you to avoid providing too much information as this in turn can lead the client to feel incompetent and a failure.

8.7.1 Learning Stages

The three stages of learning are:

Cognitive Stage: The cognitive stage is described as the early process of learning. Here the performance can vary as clients tend to make mistakes. The clients know they are doing something wrong but do not have the knowledge or expertise to correct it. This is when the assistant should demonstrate patience and point out necessary techniques in order to master the movement.

Associative Stage: In this stage, there are fewer errors as the fundamental mechanics have been acquired. Clients can now concentrate on refining their technique and skills.

Autonomous Stage: In this stage, the client has mastered the skill, so performing an exercise becomes automatic or habitual. Now the assistant can focus on teaching something new to the clients.

8.7.2 Training Approaches

While learning a new skill a person gathers information through his/her senses. The three sensory pathways used to process information are:

- **Visual Pathway:** Seeing
- **Auditory Pathway:** Hearing
- **Kinesthetic Pathway:** Touching/Handling

These pathways are in-sync with each other but most people primarily have a preference towards one: 60% people use the visual pathway, 20% access information by listening and hearing; 20% prefer to receive information by touch or handling something.

A simple way for the trainer to understand which pathway a client prefers is by listening carefully to his/her query. For example if a client says/asks:

- *Can you show me that again please? Here the client is using a visual pathway*
- *Can you explain that to me again please? Here the client is using listening/hearing pathway*
- *I would like to hold the weights before I start the exercise. Here the client is using touch pathway.*

Once the trainer identifies channel of communication, there are two general methods or approaches to teaching:

***Part Approach:** This approach is used when the each exercise is broken down into smaller bits. Each part is then practised and performed separately at first. For example: learning to do squats utilizing the correct form.*

***Whole Approach:** This approach is used when the exercise is relatively less intricate. For example: riding a stationary bike.*

Summary

- As a professional gym instructor people should notice you but for the right reasons! You can create a positive impression by being responsible, proactive, dress well and interact discreetly with clients.
- Establishing a trainer-client relationship is very important. This can be done by building rapport, by investigating the client's needs, by planning an exercise program as per the need and by executing or auctioning the plan well.
- How you dress and what you wear defines your looks and the impression that you create on people when they look at you.
- Communicating effectively by using the techniques of communication will help improve your relationship with your client.
- Always provide positive feedback to encourage clients to up their performance. Never discourage always motivate
- It is important to maintain a line or boundary while interacting with a client in the gym.
- When a person learns a new skill, he goes through three stages of learning. These stages will help you to avoid providing too much information as this in turn can lead the client to feel incompetent and a failure.

Notes

Exercise

Answer the following questions:

State whether the following statements are true or false

Q1. **You should always talk on your mobile phone, especially in the workout area.**
a. True
b. False

Q2. **At the gym you are promoting health and fitness, so it is unwise to come to the gym when you are unwell.**
a. True
b. False

Q3. **During the rapport building stage it is essential for the trainer and client to understand each other.**
a. True
b. False

Q4. **PAR-K test is used in the investigation stage.**
a. True
b. False

Q5. **Cosmetic goals include reshaping the body.**
a. True
b. False

Fill in the blanks:

1. **A person will always be successful if he _____well.**
a. Communicates
b. Dances
c. Listens
d. Sings

2. **Always confirm with your clients that your _____ is received.**
a. Lesson
b. Message
c. Letter
d. Invitation

3. **Always stay _____.**
a. Negative
b. Dismissive
c. Positive
d. Permissive

4. **As a Gym Assistant, you need to position yourself as a _____and not a Buddy.**
a. Professional
b. Socialite
c. Actor
d. Teacher

5. **In the _____the performance of the client can vary and they tend to make mistakes**
a. Associative Stage
b. Learning Stage
c. Autonomous Stage
d. Cognitive Stage

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9. Employability Skills

Unit 9.1 - Employability Skills - 60 hours

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10. Annexures

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Annexure

S. No.	Module	Unit No.	Topic Name	Page No.	URL(s)	QR Code(s)
1	1	1.2	About Beauty & Wellness Sector	5	https://youtu.be/7nDm_myL6B4	Click/Scan this QR Code to access the related video
2	2	2.1	Maintain Workarea	13	https://www.youtube.com/watch?v=9sgp1XGESuU	Click/Scan this QR Code to access the related video
3			Prepare & Maintain Workarea		https://youtu.be/m2vchOfkvho	Click/Scan this QR Code to access the related video
4	3	3.1	Basics of Anatomy	41	https://www.youtube.com/watch?v=mCIw9f1r6Io&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=5	Click/Scan this QR Code to access the related video
5		3.10	Health Psychology	91	https://www.youtube.com/watch?v=QOt4V0lI1Tc&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=9	Click/Scan this QR Code to access the related video
6	5	5.2	**Muscles and their actions**	133		
			Postural Assessment		https://www.youtube.com/watch?v=-tOAnJwUWIg&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=7	Click/Scan this QR Code to access the related video
7			Personal Trainer Orientation		https://www.youtube.com/watch?v=rcKbz9z7GLs&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=7	Click/Scan this QR Code to access the related video
8			Thomas Test		https://www.youtube.com/watch?v=Mey0_7QKpjo&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=6	Click/Scan this QR Code to access the related video
9			Core Practical		https://www.youtube.com/watch?v=rhcFO3wRQYI&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=3	Click/Scan this QR Code to access the related video
10			Legs Practical		https://www.youtube.com/watch?v=ThJ63w-5m9E&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=2	Click/Scan this QR Code to access the related video
11	6	6.3	**Factors effecting flexibility**	142		
			Olympic Weightlifting		https://www.youtube.com/watch?v=9Kl-PFrDcpE&list=PLR4U29Ux1mCln-mlpjnbC2RSHprKL1kz5&index=1	Click/Scan this QR Code to access the related video

S. No.	Module	Unit No.	Topic Name	Page No.	URL(s)	QR Code(s)
12	7	7.1	Guidelines on Health Hygiene	164	https://youtu.be/ktAYvoSEKhM	Click/Scan this QR Code to access the related video
13	8	8.3	Creating a Positive Impression at Workplace	177	https://youtu.be/XGVwVEB8EUA	Click/Scan this QR Code to access the related video

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