

Draft Study Material

GENERAL FITNESS TRAINER

Qualification Pack Code: SPF/Q1107

Sector: Physical Education and Sports

Class XII



PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION

(A constituent unit of NCERT, under Ministry of Education, Government of India)

Shyamla Hills, Bhopal- 462 002, Madhya Pradesh, India

www.psscive.ac.in

Draft Study Material

GENERAL FITNESS TRAINER

QUALIFICATION PACK: Ref. Id. SPF/Q1107

SECTOR: SPORTS, PHYSICAL EDUCATION, FITNESS & LEISURE

CLASS XII

© PSS Central Institute of Vocational Education, Bhopal 2026

No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the publisher.

PREFACE

Skill Education is a dynamic and evolving field, and ensuring that every student has access to quality learning resources is of paramount importance. The absence of finalised study material should not hinder the educational progress of students in schools. To address this need, the PSS Central Institute of Vocational Education (PSSCIVE) presents this Draft Study Material, a provisional yet comprehensive resource, designed to support the teaching-learning process until the official study materials or textbooks are released by the National Council of Educational Research and Training (NCERT).

This draft study material provides a structured, accessible, and curriculum-aligned framework for both teachers and students during the interim period. The content has been carefully developed to ensure continuity in learning and to help students achieve the prescribed learning outcomes. The content of the draft study material covers essential concepts, practical competencies, and skill-based knowledge in accordance with the curriculum and established educational standards.

The primary objective of this material is to sustain the momentum of skill education and facilitate effective classroom transactions while the finalised textbooks are under preparation. It serves as a guiding resource that can be adapted and enriched to meet the diverse learning needs of students.

We express our sincere gratitude to the academicians, educators, subject matter experts, industry professionals, academic consultants, and all other contributors whose expertise and valuable insights have made the development of this draft study material possible.

Teachers are encouraged to use this draft study material as a guiding resource and to supplement it with additional learning materials, practical activities, and contextual examples that cater to the unique needs and learning styles of their students. We welcome constructive feedback and suggestions, particularly from teachers and practitioners, to further enhance the content and effectiveness of this study material.

We hope that this draft study material serves as a valuable resource in fostering knowledge, skills, and employability among students, while supporting the successful implementation of skill education programmes across the country.

Deepak Paliwal
Joint Director

PSS Central Institute of Vocational Education

22 September 2026
Bhopal

ABOUT THE BOOK

A General Fitness Trainer plays a vital role in promoting health, physical fitness, well-being, and an active lifestyle in modern society. With increasing awareness of the importance of healthy living and preventive health care, individuals are seeking professional guidance to improve their strength, endurance, flexibility, mobility, and overall physical fitness. A competent fitness trainer must therefore possess a sound understanding of nutrition, exercise science, fitness assessment, programme design, safety, special population needs, technology, and professional practice.

The General Fitness Trainer study material for Class XII has been structured into five comprehensive units. Together, these units provide the knowledge, skills, and professional competencies required to plan and deliver safe, effective, personalised, and ethical fitness programmes.

Unit 1 on Nutrition Foundations and Exercise Nutrition introduces the fundamentals of nutrition and their application to physical activity and fitness. It covers nutrients, balanced diets, energy requirements, exercise nutrition and nutrient timing, hydration, digestion, recovery, and dietary supplements. The unit also addresses nutrition myths and the importance of evidence-based guidance.

Unit 2 on Anatomy, Movement and Exercise Physiology develops an understanding of the human body and its responses to exercise. It covers anatomical movement foundations, planes of movement, muscle structure and function, muscle fibre types, neuromuscular coordination, energy systems, Adenosine Triphosphate production, exercise intensity, and energy demands. The unit also examines cardiorespiratory function, including heart function, blood circulation, breathing, exercise responses, recovery, and heart-rate monitoring.

Unit 3 on Exercise Readiness, Fitness Assessment and Body Composition describes the principles and practices of safe fitness assessment. It covers health screening, exercise-readiness questionnaires, fitness components, assessment and testing methods, interpretation of Physical Activity Readiness Questionnaire results, and appropriate referral for medical advice. The unit also introduces body composition assessment, its relationship with health and fitness, ethical considerations, and the importance of using assessment findings to develop safe and personalised exercise plans.

Unit 4 on Exercise Programme Design and Training Principles provides a comprehensive understanding of systematic exercise programme development. It covers the Frequency, Intensity, Time, and Type principles, strength and endurance training, exercise technique and biomechanics, Specific, Measurable, Achievable, Relevant, and Time-bound goal setting, individualisation, safety, recovery, progress monitoring, and programme modification.

Unit 5 on Special Populations, Fitness Technology and Career Readiness deals with safe and inclusive delivery of exercise programmes for individuals with diverse needs and abilities. It covers exercise precautions, risk management, monitoring techniques, fitness technology, digital fitness tools, and emerging applications of artificial intelligence in the fitness sector. The unit also highlights data privacy, professional communication, ethical practice, career development, and entrepreneurship opportunities within the fitness and sports industry.

This book provides a comprehensive foundation in nutrition, exercise science, fitness assessment, exercise programme design, special population training, technology, and career development, equipping learners with the knowledge and skills required for safe, effective, inclusive, and ethical client-centred professional practice.

Vinay Swarup Mehrotra
Professor and Head
Curriculum Development and Evaluation Centre

STUDY MATERIAL DEVELOPMENT COMMITTEE

MEMBERS

Alok Mishra, *Associate Professor*, Department of Physical Education, Barkatullah University, Bhopal.

Avishek Baisya, *Physical Education & Sports Officer*, Student Activity Centre, IIT (ISM), Dhanbad.

Chirag Sethi, *Managing Director*, Classic Fitness Group, Delhi.

Rakesh Kumar, *General Manager & COO (Self-Defense)*, Sports, Physical Education, Fitness and Leisure Skills Council, Delhi.

Sonam Singh, *Assistant Professor* (Security, Defence Science and Military Science), Department of Humanities, Science, Education and Research, PSS Central Institute of Vocational Education, Bhopal.

Vijay Singh Rawat, *Officer (Students Activity and Sports)*, Physical Education and Sports Section, Maulana Azad National Institute of Technology, Bhopal.

Vishal Singh Sengar, *Assistant Professor*, Bhopal School of Social Sciences, Bhopal.

MEMBER-COORDINATOR

Vinay Swarup Mehrotra, *Professor and Head*, Department of Agriculture and Animal Husbandry, Curriculum Development and Evaluation Centre and Centre for International Relationship, PSSCIVE, Bhopal, Madhya Pradesh.

ACKNOWLEDGEMENT

The PSS Central Institute of Vocational Education (PSSCIVE) gratefully acknowledges the Department of School Education and Literacy (DoSE&L), Ministry of Education, Government of India, for the financial support under the project for curriculum and textbooks development, approved by the Project Approval Board (PAB) through *Samagra Shiksha*.

The PSS Central Institute of Vocational Education sincerely appreciates the Chief Executive Officer and the entire team of the Sports, Physical Education, Fitness, and Leisure Skills Council (SPEFL-SC), New Delhi, for their valuable support, guidance, and technical inputs in the development of the Qualification Pack (QP) for the job role of General Fitness Trainer.

PSSCIVE also extends its sincere appreciation to all the subject experts for their valuable contributions, technical expertise, constructive suggestions, and continued support in the development and refinement of this learning resource.

PSSCIVE further acknowledges with sincere appreciation the dedicated efforts and valuable contributions of Dr. Deepti Kavathekar, Consultant (Contractual); Dr. Pratima Sahu, Consultant (Contractual); Dr. Sourabh Meshram, Consultant (Contractual); Ms. Akansha Dubey, Senior Editor (Contractual); Mr. Jitendra Kumar, Graphic Designer (Contractual); and Mr. Mohit Jain, DTP Operator (Contractual). Their commitment, expertise, and meticulous efforts have contributed significantly to the development, editing, design, and production of this learning resource and to bringing it to its final form.

TABLE OF CONTENTS

S.No.	Title	Page Number
	Preface	i
	About the Book	ii
	Study Material Development Committee	iv
	Acknowledgements	v
1.	Diet and Nutrition for General Fitness Trainers	1
	Session 1: Nutrition Foundations	1
	Session 2: Nutrition Timing Around Exercise	7
	Session 3: Hydration and Digestion Awareness	12
	Session 4: Supplements, Myths, and Professional Limits	16
2.	Applied Kinesiology and Physiology	23
	Session 1: Anatomical Foundations of Movement	23
	Session 2: Muscles and Movement Basics	30
	Session 3: Energy Systems and Exercise Response	37
	Session 4: Cardiorespiratory Response	41
3.	Health Screening and Fitness Assessment	46
	Session 1: Exercise Readiness	47
	Session 2: Fitness Assessment Components	52
	Session 3: Readiness Questionnaires	58
	Session 4: Body Composition Awareness	65
4.	Exercise Science and Programme Design	71
	Session 1: Structure of an Exercise Programme	71
	Session 2: Strength and Endurance Principles	76
	Session 3: Exercise Mechanics	80
	Session 4: Goal-Oriented Programme Planning	87
5.	Special Populations, Technology, and Career Preparation	92
	Session 1: Special Population Training Awareness	92
	Session 2: Exercise Precautions	98
	Session 3: Fitness Technology	102
	Session 4: Career Readiness and Professional Development	108
	Answer Key	113
	Glossary	119

Unit 1 Diet and Nutrition for General Fitness Trainers

Unit 1 on ***Diet and Nutrition for General Fitness Trainers*** introduces practical knowledge of nutrition knowledge, covering balanced diets, hydration, digestion, supplements, and professional guidance to support exercise performance, recovery and fitness goals.

[1] ***Nutrition Foundations*** deals with nutrition and fitness, including nutrients, hydration, balanced diets, energy needs and nutrition's role in supporting exercise, recovery, and fitness goals.

[2] ***Nutrition Timing Around Exercise*** explains nutrition timing before, during and after exercise, focusing on energy requirements, hydration, activity demands, and common nutrition mistakes.

[3] ***Hydration and Digestion Awareness*** covers hydration and digestion, focusing on fluid balance, exercise performance, nutrient absorption, digestive health, recovery, and practical nutrition guidance.

[4] ***Supplements, Myths, and Professional Limits*** helps in understanding the key concepts relating to supplements, nutrition myths, evidence-based nutrition, food allergies and food intolerances, and trainers' responsibilities, professional limits and referral practices.

Session 1: Nutrition Foundations

Nutrition is closely linked to fitness because physical activity can increase the need for energy and nutrients. Nutrition refers to the way the body obtains and uses nutrients from food and beverages for energy, growth, repair, and normal body functions. For a fitness trainer, basic knowledge of nutrition is important to explain the connection between food and exercise, encourage healthy eating habits, and guide clients towards making informed choices.

Different nutrients have different roles. Carbohydrates, proteins, and fats provide energy and support various body functions, while vitamins and minerals help regulate essential processes. Therefore, regular physical activity, combined with appropriate nutrition, plays an important role in maintaining fitness and promoting healthy living. This session introduces essential nutrients and explains their role in maintaining fitness.

1. Nutrients and their Role in Fitness

Nutrients are essential substances obtained from food that the body requires for energy production, growth, development, tissue repair, and the maintenance of

normal physiological functions. They are broadly classified into macronutrients, such as carbohydrates, proteins, and fats, which are required in relatively large amounts, and micronutrients, such as vitamins and minerals, which are needed in smaller amounts but are essential for maintaining health and supporting various metabolic processes (Fig. 1.1). Understanding their functions and identifying appropriate food sources help fitness trainers guide clients towards balanced eating habits and avoid unnecessary dietary restrictions.

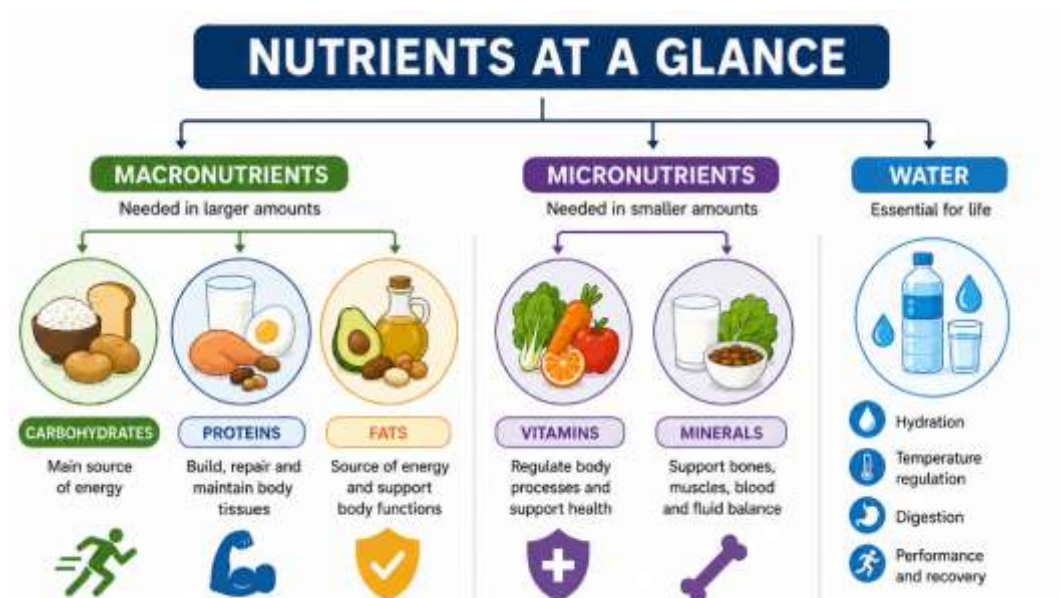


Fig. 1.1: Major nutrients supporting fitness and physical activity

(a) Macronutrients

The following macronutrients are particularly important in supporting physical activity and overall well-being:

- (i) Carbohydrates:** Carbohydrates are an important source of energy, especially during moderate-to-high-intensity physical activity. Foods such as rice, wheat, bread, potatoes, fruits, vegetables, pulses, and legumes provide carbohydrates. The body also stores carbohydrates as glycogen, which can be used during exercise. A fitness trainer should help clients recognise the importance and role of carbohydrates in providing energy rather than encouraging unnecessary restrictions or complete elimination of these foods.
- (ii) Proteins:** Proteins are made up of amino acids and are needed for the growth, maintenance, and repair of body tissues. They are particularly important in fitness because exercise places stress on muscles and adequate nutrition supports muscle recovery. Common sources of protein include milk and dairy products, eggs, fish, meat, soy, pulses, beans, nuts and seeds. Individual protein requirements may vary, so specific dietary recommendations should be provided by appropriately qualified professionals.

(iii) Fats: Fats provide energy and support several important functions, including supporting cell structure and helping the body to absorb certain vitamins. Sources include nuts and seeds, vegetable oils, avocados, dairy products, fish and other animal foods. Fats are an essential part of a healthy diet, and both the quality and quantity of fats are important when making food choices.

(b) Micronutrients

Vitamins and minerals are micronutrients required in relatively small amounts but essential for maintaining normal body functions and supporting growth, development, and overall health. Vitamins such as A, B-group, C, and D play important roles in vision, energy metabolism, tissue maintenance, immune function, and bone health. Minerals such as calcium, iron, potassium, and sodium contribute to bone strength, oxygen transport, muscle and nerve function, and fluid and electrolyte balance. A varied and balanced diet can provide most essential vitamins and minerals in adequate amounts. Fitness trainers may explain their basic nutritional roles and encourage healthy dietary practices. However, they should not diagnose nutrient deficiencies or prescribe supplements or treatments for medical conditions.

2. Water

Water is essential for life and plays a vital role in maintaining normal body functions. It is particularly important during exercise, when the body loses fluids through sweating and increased breathing. Adequate hydration helps regulate body temperature, maintain blood circulation, support digestion, lubricate joints, and sustain physical performance and recovery. Even mild dehydration can contribute to fatigue, reduced concentration, decreased exercise capacity, and impaired performance.

A general fitness trainer should guide clients in developing practical hydration habits by encouraging regular fluid intake throughout the day and around exercise sessions. Trainers can remind clients to drink fluids before, during, and after exercise, particularly during prolonged or intense workouts or in hot and humid conditions. They should also encourage clients to pay attention to thirst, urine colour, body weight changes, and signs of dehydration such as dizziness, headache, unusual fatigue, or reduced performance. For clients with medical conditions or specific fluid or electrolyte requirements, the trainer should refer them to a qualified healthcare professional or registered dietitian rather than providing medical advice or prescribing a personalised hydration treatment.

3. Balanced Diet and Fitness

A balanced diet includes a variety of foods in appropriate amounts to meet the body's energy and nutrient needs. It includes cereals and other carbohydrate sources, vegetables, fruits, pulses and other protein-rich foods, milk and dairy products or suitable alternatives, nuts and seeds and appropriate sources of fats.

A balanced diet helps the body fuel physical activity, support physical performance, aid recovery after exercise and maintain overall health (Fig. 1.2). However, nutritional needs vary from person to person depending on factors such as age, body size, activity level, health status and individual circumstances.



Fig. 1.2: Components of a balanced diet

4. Relationship of Energy with Physical Activity

The body requires energy for essential functions such as breathing, circulation, movement and maintaining body temperature, as well as for physical activity. Food provides energy mainly from carbohydrates, fats and proteins. This relationship between energy and physical activity is illustrated in Fig. 1.3.

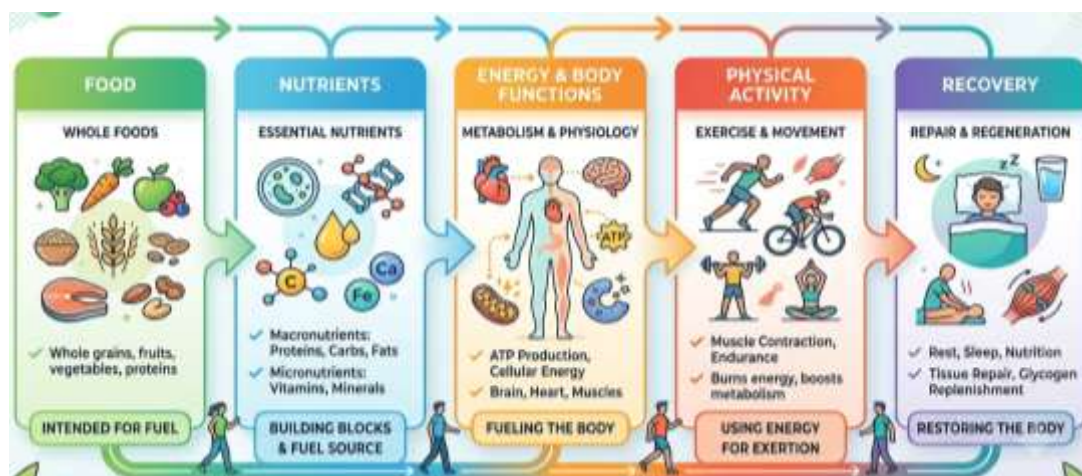


Fig. 1.3: Relationship between energy and physical activity

Energy requirements differ among individuals. Therefore, general fitness trainers should focus on general nutrition education and healthy food choices rather than prescribing individualised diets. When specific dietary or medical advice is required, clients should be referred to appropriately qualified nutrition or healthcare professionals.

5. Nutrition and Fitness Goals

Nutrition needs are also influenced by a person's fitness goals and activity level. For example, a person involved in strength training needs adequate energy and protein-rich foods as part of a balanced diet, while someone participating in endurance activities may need sufficient energy, carbohydrate-rich foods and fluids. A general fitness trainer should consider the client's fitness goal and activity pattern when providing general nutrition guidance. Such guidance should remain within the trainer's professional scope and should not be presented as an individualised diet plan.

Practical Exercise

Activity 1: Create a balanced diet chart

Materials Required:

1. Food cards/pictures
2. Chart paper
3. Paper plate
4. Glue
5. Scissors
6. Marker

Procedure:

- Form groups of 3–4 students.
- Collect the food cards/pictures provided by your teacher.
- Identify the main nutrients present in the foods and group them as carbohydrate-, protein-, or fat-rich foods. Also identify fruits and vegetables.
- Select suitable foods and create a balanced plate for a physically active person.
- Discuss how your selected foods can provide energy, support physical activity, recovery and overall health.
- Present the plate to the class and explain the reasons for your food choices.

Activity 2: Role-play to act as a general fitness trainer

Materials Required:

1. Case cards
2. Notebook
3. Pen

Procedure:

- Form pairs. One student will act as the general fitness trainer and the other as the client.
- Read the client profile given by your teacher. Identify the client's fitness goal and activity level.
- Discuss the general nutrition needs that may be relevant to the client, such as energy, carbohydrate-containing foods, protein-rich foods, or fluids.
- The student acting as the trainer should provide general nutrition guidance based on the concepts learned in this session.
- Discuss what advice a general fitness trainer should not provide and when the client should be referred to a qualified nutrition or healthcare professional.

Check Your Progress

A. Multiple Choice Questions

1. Why is nutrition important for a person who regularly exercises?
 - a) It only helps in reducing body weight
 - b) It provides energy and supports performance and recovery
 - c) It eliminates the need for exercise
 - d) It prevents all health problems
2. Which of the following is a macronutrient?
 - a) Vitamin C
 - b) Calcium
 - c) Protein
 - d) Iron
3. Which nutrient is particularly important as a source of energy during moderate- to high-intensity physical activity?
 - a) Carbohydrates
 - b) Vitamins
 - c) Minerals
 - d) Water
4. A general fitness trainer should refer a client to a qualified nutrition professional when the client_____.
 - a) wants to know about healthy food choices
 - b) needs general information about hydration
 - c) requires an individualised diet plan
 - d) asks about the role of protein in fitness
5. Which statement best describes a balanced diet?
 - a) Eating only protein-rich foods
 - b) Avoiding fats and carbohydrates completely

- c) Eating a variety of foods in appropriate amounts
- d) Eating the same food every day

B. Fill in the Blanks

1. _____ refers to the way the body obtains and uses nutrients from food and beverages.
2. Carbohydrates, proteins and fats are known as _____.
3. The body stores carbohydrates in the form of _____, which can be used during exercise.
4. Adequate _____ helps regulate body temperature and supports physical performance during exercise.
5. A general fitness trainer should provide general nutrition guidance but should not prescribe _____ diets.

C. Subjective Questions

1. Explain the relationship between nutrition and physical fitness.
2. What are macronutrients? Explain the role of carbohydrates, proteins and fats in fitness.
3. Why are vitamins, minerals and water important for a physically active person?
4. What is a balanced diet? Explain how it supports physical activity and recovery.
5. A client who has started strength training asks you to prepare an individualised diet plan for them. As a general fitness trainer, how would you respond? Explain what general guidance you can provide and when you should refer the client to a qualified professional.

What have you learned?

After completing this session, you will be able to:

- describe the importance of nutrition for physical activity, fitness, performance and recovery;
- identify major nutrients and describe their basic functions;
- explain the importance of a balanced diet and adequate hydration; and
- explain basic nutrition principles within a general fitness trainer's professional scope.

Session 2: Nutrition Timing Around Exercise

Nutrition timing means planning food and fluid intake before, during and after exercise. It supports energy availability, performance, recovery, hydration and exercise comfort. General fitness trainers should consider individual goals, schedules, preferences and tolerance. Appropriate nutrition timing can help support energy availability, exercise performance, recovery, hydration and comfort during

exercise. For general fitness trainers, understanding these principles is important because clients have different exercise schedules, fitness goals, food preferences and individual tolerances. This will help to relate food and fluid intake to the type, duration and intensity of exercise. The following section discusses how nutrition timing can be adapted according to exercise duration and the specific demands of the activity.

1. Nutrition Timing and Exercise

The timing of nutrition in relation to exercise can influence energy availability, performance, hydration and recovery. Some of these are as follows:

(i) Nutrition before exercise: Pre-exercise nutrition provides energy, controls hunger, supports performance and reduces digestive discomfort. Meals several hours before exercise can be larger, while smaller snacks are useful closer to training. Carbohydrate-rich foods with moderate protein and suitable fat and fibre are generally appropriate.

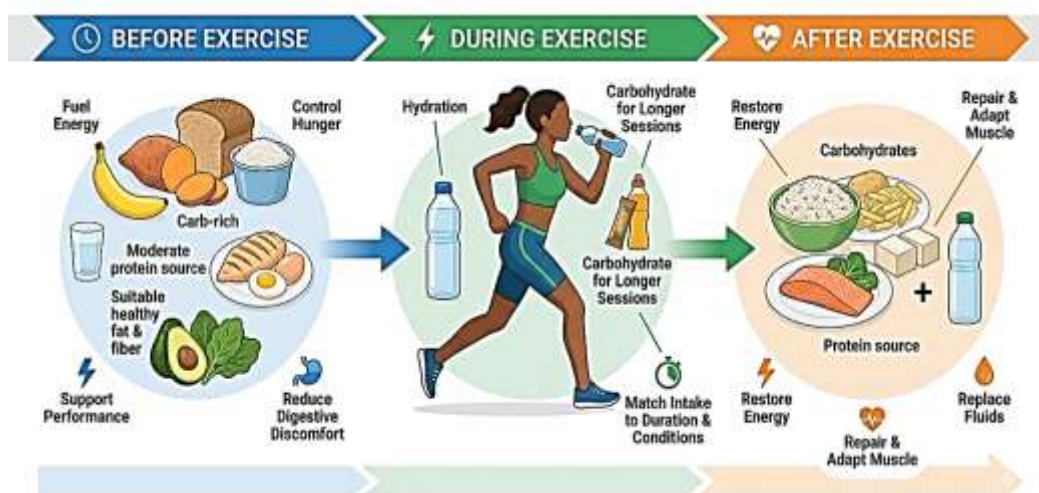


Fig. 1.4: Nutrition timing around exercise

(ii) Nutrition during exercise: Nutrition during exercise is particularly important for prolonged, intense, or demanding activities. Carbohydrates may be useful during longer sessions. Hydration should be planned according to exercise duration, environmental conditions and individual needs.

(iii) Nutrition after exercise: Post-exercise nutrition supports recovery, replenishes energy stores, repairs muscles and restores fluids. Carbohydrates help replace energy stores, while protein supports muscle repair and adaptation. Balanced meals and fluids are important.

2. Nutrition Timing for Different Activities

Strength training requires practical meal and snack planning. Cardiorespiratory exercise needs vary with duration. Endurance activities require greater attention to

carbohydrate and fluid intake, while recreational activities generally need simpler strategies. Meals and snacks should be organised around morning, afternoon, or evening exercise. Pre-workout snacks should consider timing, portion size, carbohydrates and tolerance. Post-workout meals should include carbohydrates, protein and fluids. Early-morning and after-school or work sessions may require practical snack planning.

3. Common Nutrition Timing Mistakes

Common nutrition-timing mistakes include exercising soon after consuming a heavy meal, consuming insufficient energy to support training demands, overeating after exercise, and failing to maintain adequate hydration (Fig. 1.5). General fitness trainers should apply basic principles of nutrition timing, consider clients' exercise schedules and hydration requirements, and provide simple, safe guidance within their professional scope of practice. Any individualised dietary concerns, medical conditions, or specialised nutrition requirements should be referred to a qualified nutrition or healthcare professional.



Fig. 1.5: Common nutrition timing mistakes

Practical Exercise

Activity 1: Pre-, During- and Post-Exercise nutrition

Materials Required:

1. Nutrition-timing worksheet
2. Food pictures or nutrition charts
3. Pen or pencil
4. Water bottle

Procedure:

- Identify suitable foods and beverages to consume before physical activity and discuss how timing and portion size may affect exercise performance.
- Discuss the importance of hydration and identify appropriate fluid choices during exercise.
- Identify suitable foods and beverages that can support recovery after physical activity.

- Match different foods and fluids with exercise activities of varying duration and intensity.
- Complete the worksheet by recording suitable food/fluid choices and recommended timing for before, during, and after exercise.
- Compare responses in small groups and explain the reasons for the choices made.

Activity 2: Identifying nutrition-timing mistakes

Materials Required:

1. Case-study sheets
2. Nutrition checklist
3. Pen or pencil

Procedure:

- Read the given scenario and identify the individual's eating and hydration practices around exercise.
- Use the checklist to identify common issues such as eating a heavy meal immediately before exercise, inadequate energy intake, excessive post-exercise eating, or insufficient hydration.
- Discuss how these practices may affect comfort, energy levels, hydration, and exercise performance.
- Recommend simple and practical improvements to the timing of meals, snacks, and fluids.
- Discuss situations in which an individual should seek personalised advice from a qualified nutrition or healthcare professional.
- Present the identified mistakes and suggested corrections to the class.

Check Your Progress

A. Multiple Choice Questions

1. What does nutrition timing mean?
 - a) Eating only after exercise
 - b) Planning food and fluid intake before, during, and after exercise
 - c) Avoiding food during exercise
 - d) Eating only in the morning
2. What is one benefit of eating before exercise?
 - a) Increasing digestive discomfort
 - b) Supporting energy and exercise performance
 - c) Preventing hydration
 - d) Reducing recovery
3. During which type of exercise may carbohydrates be particularly useful?
 - a) Very short activities

- b) Prolonged or intense exercise
 - c) Sleeping
 - d) Light stretching only
4. Which nutrient supports muscle repair and adaptation after exercise?
 - a) Protein
 - b) Fibre
 - c) Water
 - d) Salt
 5. Which of the following is a common nutrition timing mistake?
 - a) Planning hydration
 - b) Eating a suitable snack before exercise
 - c) Exercising immediately after a heavy meal
 - d) Having a balanced post-workout meal

B. Fill in the Blanks

1. Nutrition timing involves planning food and _____ intake before, during and after exercise.
2. Pre-exercise nutrition can provide energy, control hunger and reduce _____ discomfort.
3. During prolonged exercise, _____ may be useful to support energy needs.
4. After exercise, protein supports muscle _____ and adaptation.
5. Common nutrition timing mistakes include inadequate energy intake and inadequate _____.

C. Subjective Questions

1. A client exercises early in the morning and does not have enough time for a full meal. What practical nutrition timing advice could a general fitness trainer provide?
2. A client plans to exercise immediately after eating a heavy meal and often experiences stomach discomfort. How could the trainer help the client improve their pre-exercise nutrition timing?
3. What is nutrition timing, and why is it important for exercise performance and recovery?
4. Explain the importance of nutrition before, during and after exercise.
5. What are the common mistakes in nutrition timing during exercise?

What have you learned?

After completing this session, you will be able to:

- explain the concept and importance of nutrition timing;
- elaborate on nutrition needs before, during and after exercise;
- identify nutrition strategies for different activities;

- classify common nutrition timing mistakes; and
- demonstrate basic nutrition and hydration planning around exercise.

Session 3: Hydration and Digestion Awareness

Hydration and digestion are essential for maintaining health, energy and physical performance. Adequate fluids regulate body temperature and support nutrient transport, while proper digestion helps the body absorb nutrients needed for energy, muscle function and recovery. This session highlights simple ways to maintain good hydration and digestive health during physical activity.

1. Hydration Awareness

During exercise, sweating causes fluid loss, influenced by exercise intensity, duration, temperature, humidity, clothing and individual sweat rate. For general fitness trainers, cognisance of hydration (Fig. 1.6) is necessary for the following reasons:

(i) Recognising hydration status: Thirst, urine colour and symptoms such as dry mouth, headache, dizziness, fatigue and reduced exercise capacity can provide useful clues about hydration. Trainers should recognise individual differences and encourage clients to maintain regular fluid intake.

(ii) Hydration before, during and after exercise: Clients should begin exercise adequately hydrated and drink regularly during prolonged activity. For most moderate sessions, plain water is sufficient. During prolonged or intense exercise, particularly in hot conditions, electrolyte replacement may be appropriate. After exercise, fluids should be replaced to restore balance.

(iii) Fluid balance during exercise: Fluid balance occurs when fluid intake matches fluid loss. Sweating reduces body water and blood volume, increasing cardiovascular strain. Dehydration may cause increased heart rate, fatigue, reduced endurance, dizziness and impaired coordination. Sweat also contains electrolytes such as sodium and potassium, which support nerve and muscle function.



Fig. 1.6: Hydration and exercise

2. Role of Digestion in Fitness Training

Digestion breaks food into nutrients that can be absorbed and used for energy, growth and repair. The mouth begins digestion through chewing and saliva. The stomach uses acids and enzymes, mainly supporting protein digestion. The small intestine is the primary site of digestion and absorption, where carbohydrates, proteins and fats are converted into usable components. The large intestine absorbs water and forms waste. Understanding digestion (Fig. 1.7) helps trainers guide clients regarding food choices, meal timing and exercise comfort. For general fitness trainers, cognisance of digestion is necessary for the following reasons:

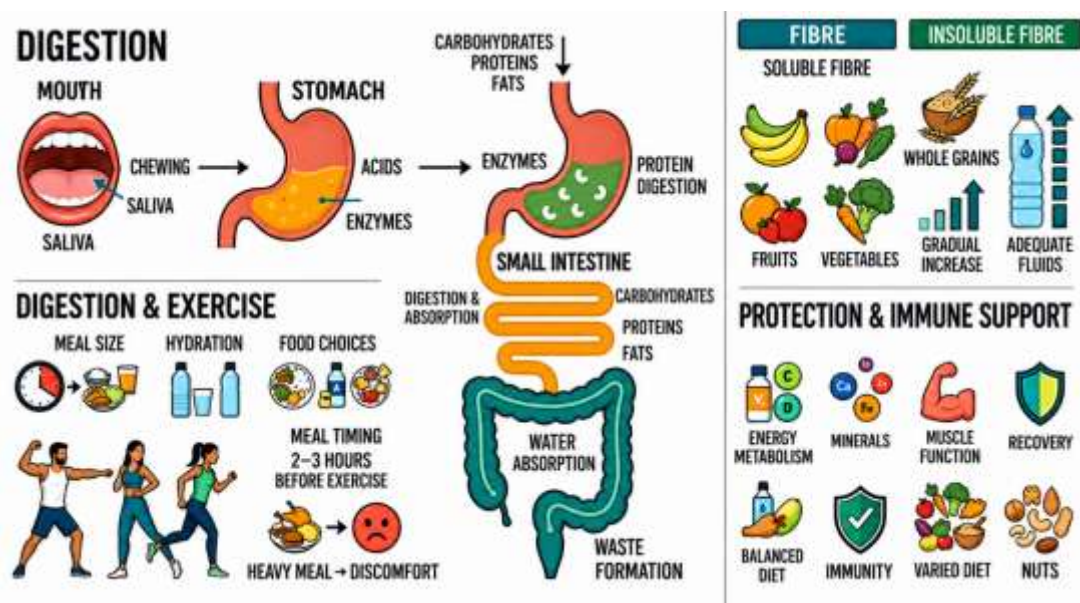


Fig. 1.7: Awareness for digestive health

- (i) **Digestion and exercise:** Meal size, hydration, food choices and timing can influence exercise comfort. Balanced meals eaten around 2–3 hours before exercise may support performance, while heavy meals immediately before activity can cause discomfort.
- (ii) **Fibre and digestive health:** Fibre supports healthy digestion and bowel function. Soluble and insoluble fibre are found in fruits, vegetables, whole grains and other plant foods. Fibre should be increased gradually alongside adequate fluid intake.
- (iii) **Protection and immune support:** Vitamins and minerals support energy metabolism, muscle function, recovery and immunity. A varied diet containing fruits, vegetables, whole grains, nuts and other diverse foods generally supports these needs.

Trainers should promote hydration, balanced nutrition, appropriate meal timing and adequate fibre intake. They should not diagnose medical conditions or prescribe therapeutic supplements unless qualified. Persistent fatigue, frequent illness,

cramps, slow recovery, or severe digestive symptoms should be referred to an appropriate healthcare or nutrition professional.

Practical Exercise

Activity 1: Identify signs of dehydration and prepare a suitable hydration plan

Material Required:

1. Hydration checklist
2. Water bottle
3. Urine colour chart
4. Pen/pencil

Procedure:

- Discuss the importance of hydration during exercise.
- Identify common signs of dehydration.
- Discuss fluid intake before, during and after exercise.
- Identify factors affecting fluid loss.
- Record suitable hydration practices.

Activity 2: Understanding digestion

Material Required:

1. Digestive system chart
2. Food pictures
3. Worksheet
4. Pen/pencil

Procedure:

- Identify the main organs of the digestive system.
- Explain the role of the mouth, stomach, small intestine and large intestine.
- Discuss how food is digested and absorbed.
- Identify foods that support healthy digestion.
- Record the main functions of each organ.

Activity 3: Digestion and exercise

Material Required:

1. Meal planning worksheet
2. Food charts
3. Case studies
4. Pen/pencil

Procedure:

- Discuss the effect of meal timing on exercise comfort.
- Identify suitable foods before exercise.
- Discuss the importance of fibre and adequate fluids.

- Identify foods that may cause discomfort before exercise.
- Prepare a simple meal and hydration plan.

Check Your Progress

A. Multiple Choice Questions

- What is the main purpose of hydration during exercise?
 - To increase body weight
 - To maintain fluid balance and support body functions
 - To reduce nutrient absorption
 - To prevent sweating
- Which of the following can provide a useful clue about hydration status?
 - Urine colour
 - Hair colour
 - Height
 - Body shape
- What may happen when a person becomes dehydrated during exercise?
 - Improved coordination
 - Increased endurance
 - Fatigue and dizziness
 - Reduced heart rate
- Which part of the digestive system is the primary site of digestion and absorption?
 - Mouth
 - Stomach
 - Small intestine
 - Large intestine
- Which of the following supports healthy digestion and bowel function?
 - Fibre
 - Excessive sugar
 - Skipping meals
 - Dehydration

B. Fill in the Blanks

- Hydration means maintaining adequate _____ levels for normal body functions and exercise performance.
- _____ during exercise causes fluid loss.
- Sweat contains electrolytes such as sodium and _____.
- The _____ intestine is the primary site of digestion and absorption.
- Fibre should be increased gradually alongside adequate _____ intake.

C. Subjective Questions

1. A client is exercising outdoors in hot and humid conditions for a long period. How should the trainer guide the client regarding fluid intake before, during and after exercise?
2. What is hydration, and why is it important during exercise?
3. Explain the process of digestion and identify the main organs involved.
4. How do hydration and digestion affect exercise performance and comfort?

What have you learned?

After completing this session, you will be able to:

- explain the importance of hydration and digestion for exercise and health;
- elaborate on hydration needs before, during and after exercise;
- identify signs of dehydration and factors affecting fluid loss;
- classify the main stages and functions of digestion; and
- demonstrate basic strategies for hydration, meal timing and digestive health.

Session 4: Supplements, Myths, and Professional Limits

Dietary supplements are products containing nutrients or other substances intended to supplement the diet. Common examples include protein powders, vitamins, minerals, electrolytes, creatine and pre-workout products. People may use them to support nutritional intake, exercise performance, recovery or specific dietary needs. However, supplements should not automatically replace whole foods, which provide nutrients along with fibre and other beneficial components. General fitness trainers should understand these supplements as they can provide safe, evidence-informed education without encouraging unnecessary use. This session covers key issues related to dietary supplements, their appropriate use, and the role of trainers in providing evidence-informed guidance.

1. Common Fitness Supplements

General fitness trainers should have a basic understanding of products used as common fitness supplements (Fig. 1.8). These products have different purposes and are not equally useful for every individual. Some of these supplements are as follows:



Fig.1.8: Common fitness supplements

(i) Protein supplements: Protein powders such as whey, casein, soy and pea help increase protein intake when food alone is insufficient. They supplement, not replace, balanced meals.

(ii) Vitamin and mineral supplements: Multivitamins and individual nutrients help address deficiencies. A varied diet usually provides enough. They do not directly improve strength or endurance.

(iii) Energy and performance enhancers: These products claim to improve stamina, focus, or exercise capacity. These products often contain caffeine, creatine, or other compounds associated with performance. Creatine and caffeine may support strength, high-intensity exercise, alertness, or stamina. Dosage, tolerance and side effects should be considered.

(iv) Hydration and electrolyte products: Electrolyte powders and sports drinks fall into another category. These products aim to replace fluids and minerals lost through sweat. They may be useful during prolonged or high-intensity exercise, especially in hot environments. For moderate sessions, plain water is often sufficient. For example, an athlete training for long-distance events may benefit from electrolyte replacement during extended sessions. A client performing short indoor workouts may not require such products.

(v) Herbal and specialised supplements: Some supplements contain herbal extracts or specialised compounds marketed for joint support, immunity, or hormonal balance. These products vary widely in quality and evidence.

Clients considering these supplements should consult healthcare professionals. Understanding supplement categories helps trainers respond to client questions accurately. Trainers should explain that supplements are additions, not substitutes. They may provide general information about supplement categories, but prescribing specific products or dosages requires appropriate qualification. Clear knowledge of common supplement categories supports responsible communication and protects client safety in fitness settings.

2. Evaluating Potential Risk of Supplements

Supplements may involve incorrect dosage, side effects, medication interactions, contamination or poor product quality. Unnecessary supplementation and products promising rapid results can create additional risks. Trainers should learn basic risk recognition and understand their professional limits, including when to refer clients to qualified professionals. Supplement marketing may use attractive terms such as ‘scientifically proven’, ‘natural’, ‘fat-burning’, or ‘rapid results’. General fitness trainers need to distinguish advertising from reliable scientific evidence. Clients should question exaggerated claims, examine the quality of evidence and avoid assuming that natural products are automatically safe or effective.

3. Nutrition myths and misconceptions

Common myths regarding nutrition include ‘carbohydrates are always bad’, ‘more protein always builds more muscle’, ‘everyone needs supplements’, ‘skipping meals guarantees fat loss’, ‘detox diets remove toxins’, ‘sports drinks are necessary for every workout’, and ‘natural products are always safe’ (Fig. 1.9). Students should learn to challenge these claims using principles of energy balance, exercise, dietary quality, individual needs and scientific evidence.

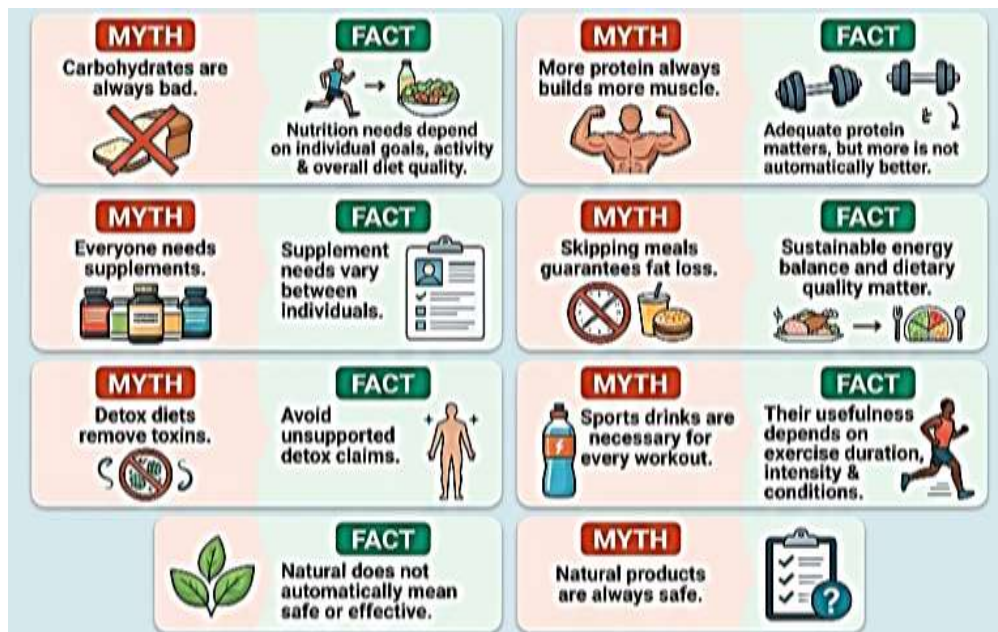


Fig. 1.9: Nutrition myths and misconceptions

4. Evidence-Based Nutrition

Evidence-based nutrition (Fig. 1.10) means using current, credible scientific evidence alongside professional knowledge and individual circumstances. Trainers should learn to evaluate online nutrition advice, identify trustworthy sources and recognise unreliable information.



Fig. 1.10: Evidence-based nutrition

Through case studies, source-comparison activities, and practical discussions, students can develop the critical thinking needed to educate clients responsibly while staying within their professional scope.

5. Trainer Responsibility and Nutritional Issues

General fitness trainers must maintain professional boundaries. They can provide general information about supplement categories and basic safety. They should not prescribe dosages or treat medical conditions unless appropriately qualified. Key responsibilities of general fitness trainers include:

- Encourage a food-first approach
- Discourage excessive or combined supplement use
- Recognise warning signs of misuse
- Recommend medical consultation when required

Supplement safety requires awareness, moderation and professional judgment. Misuse often arises from misunderstanding, marketing influence, or unrealistic expectations. In fitness training, responsible guidance protects client health and maintains professional integrity.

Food supports both health and training performance, but certain foods can cause adverse reactions in some individuals. As a trainer, it is important to have knowledge not only about supplements but also about common food allergies and intolerances, so you can better understand your clients' needs and help them train safely and effectively. These reactions may affect digestion, breathing, skin condition, or overall comfort. In fitness settings, such reactions can influence a client's ability to train safely and consistently. Therefore, general fitness trainers must develop basic awareness of food allergies and food intolerances (Fig. 1.11). The differences between these are as follows:

- A food allergy is an immune system reaction to a specific food and can cause mild to severe symptoms, even from a small amount. Common allergens include milk, eggs and peanuts.
- A food intolerance occurs when the body has difficulty digesting certain foods. It mainly causes digestive symptoms such as bloating, gas, or stomach discomfort. It is generally less severe than an allergy.



Fig. 1.11: Food allergy and food intolerance

Common symptoms of food reactions include rash, itching, swelling, nausea, abdominal pain, diarrhoea and, in severe cases, breathing difficulty.

General fitness trainers should not diagnose these conditions but should encourage clients to seek medical advice when symptoms occur. Asking about known allergies or intolerances and checking supplement ingredients helps promote client safety and effective participation in exercise programmes.

6. Scope Limits and Referral Responsibility

General fitness trainers provide exercise guidance and basic nutrition education, but they must work within their professional scope. They can explain healthy eating, hydration and recovery practices, but they should not diagnose medical conditions, prescribe therapeutic diets, recommend supplement dosages, or modify medications. When clients experience issues such as persistent fatigue, digestive problems, suspected nutrient deficiencies, chronic health conditions, severe allergies, eating disorders, or injuries, trainers should refer them to qualified healthcare professionals. Referral is a sign of professional responsibility and helps ensure client safety. Trainers should communicate referrals clearly, document relevant health information and collaborate with healthcare professionals when needed. Respecting scope limits protects clients, maintains ethical standards and strengthens professional credibility.

Practical Exercise

Activity 1: Identifying common supplements

Material Required:

1. Supplement labels/pictures
2. Supplement classification worksheet
3. Pen/pencil

Procedure:

- Identify common fitness supplements.
- Classify supplements into different categories.
- Discuss their general purposes.
- Identify possible risks and limitations.
- Emphasise a food-first approach.

Activity 2: Evaluating supplement claims

Material Required:

1. Supplement advertisements
2. Product labels
3. Claim-evaluation worksheet
4. Pen/pencil

Procedure:

- Examine common supplement claims.
- Identify exaggerated or misleading statements.
- Compare claims with available evidence.
- Discuss possible risks and side effects.
- Decide when professional referral is required.

Activity 3: Nutrition myths and food reactions**Material Required:**

1. Nutrition myth cards
2. Food allergy/intolerance charts
3. Case studies
4. Pen/pencil

Procedure:

- Identify common nutrition myths.
- Discuss whether each claim is supported by evidence.
- Differentiate food allergy from food intolerance.
- Identify common symptoms of food reactions.
- Discuss when a client should be referred to a healthcare professional.

Check Your Progress

A. Multiple Choice Questions

1. What is the main purpose of dietary supplements?
 - a) To completely replace whole foods
 - b) To supplement the diet with nutrients or other substances
 - c) To treat all medical conditions
 - d) To guarantee rapid fitness results
2. Which of the following is an example of a protein supplement?
 - a) Whey protein
 - b) Sports drink
 - c) Multivitamin
 - d) Herbal extract
3. Which statement about supplement claims is most appropriate?
 - a) All-natural products are safe
 - b) “Rapid results” claims should always be trusted
 - c) Trainers should evaluate the quality of scientific evidence
 - d) Advertising is always based on scientific research

4. What is the main difference between a food allergy and a food intolerance?
 - a) An allergy involves the immune system, while an intolerance mainly involves difficulty digesting food
 - b) An intolerance is always more severe than an allergy
 - c) An allergy only causes digestive symptoms
 - d) There is no difference between them
5. When should a general fitness trainer refer a client to a qualified healthcare professional?
 - a) When the client asks about healthy hydration
 - b) When the client wants general information about balanced nutrition
 - c) When the client has severe allergies or persistent health-related symptoms
 - d) When the client wants to improve exercise performance

B. Fill in the Blanks

1. Supplements are intended to _____ the diet rather than automatically replace whole foods.
2. Protein powders such as whey, casein, soy and pea can help increase _____ intake.
3. Trainers should distinguish supplement advertising from reliable scientific _____.
4. A food _____ is an immune system reaction to a specific food.
5. General fitness trainers should work within their professional _____ and refer clients when specialist advice is required.

C. Subjective Questions

1. A client tells you that they want to start taking several supplements because an advertisement promises “rapid muscle growth.” How should the trainer respond while staying within their professional scope?
2. A client asks whether they need an electrolyte drink during every workout. What factors should the trainer consider before providing general guidance?
3. What are dietary supplements? Give any three common examples.
4. What are the common risks and misconceptions associated with dietary supplements?
5. Differentiate between a food allergy and a food intolerance.

What have you learned?

After completing this session, you will be able to:

- explain the importance of dietary supplements in supporting nutritional needs;
- identify common types of dietary supplements and their uses;
- evaluate supplement claims using reliable scientific evidence; and
- differentiate between food allergies and food intolerances.

Unit 2 Applied Kinesiology and Physiology

Unit 2 on **Applied Kinesiology and Physiology** builds up a strong foundation in kinesiology, muscle function, energy systems and cardiorespiratory responses, enabling trainers to understand movement and design safe, effective exercise programmes.

[1] **Anatomical Foundations of Movement** introduces kinesiology concepts, including anatomical position, exercise positions, movement planes and axes, supporting accurate and safe exercise instruction.

[2] **Muscles and Movement Basics** explains muscle types, skeletal muscle structure, fibre classification, recruitment, training adaptations and neuromuscular coordination for effective fitness training.

[3] **Energy Systems and Exercise Response** introduces exercise physiology, ATP, energy systems, exercise intensity and energy demands, helping trainers design effective programmes for strength, power, endurance and fitness.

[4] **Cardiorespiratory Response** explains cardiorespiratory fitness, heart function, blood circulation, breathing, exercise responses, recovery and heart-rate monitoring for safe cardiovascular training.

Session 1: Anatomical Foundations of Movement

Kinesiology helps general fitness trainers understand how bones, joints, muscles, and other structures work together to create movement. This knowledge provides a foundation for teaching proper exercise technique, recognising movement patterns, correcting form, promoting safe exercise, and reducing injury risk. The session aims to help trainers understand basic anatomy, kinesiology, and movement classification, enabling them to teach exercises correctly, recognise movement patterns, improve technique, and promote safe training practices.

1. Anatomical Position

Accurate movement instruction requires a fixed reference point. In anatomy, this reference point is known as the anatomical position. It provides a standard starting posture from which all body movements and joint actions are described. Without this common reference, communication about movement would lack precision. An anatomical position does not represent a natural resting posture. It is a defined and agreed-upon position used for description and analysis. In anatomical position, the body stands upright with specific alignment features.

- i) The head faces forward.
- ii) The eyes look straight ahead.
- iii) The arms rest at the sides of the body.
- iv) The palms face forward.
- v) The fingers extend naturally.
- vi) The legs remain straight.

- vii) The feet point forward and remain slightly apart.

Figure 2.1 illustrates the anatomical position of body.

Orientation and Directional Terms

Anatomical position allows the use of directional terminology. Terms such as anterior, posterior, medial, lateral, superior and inferior depend on this standard posture. The terms are explained below:

- Anterior refers to the front of the body.
- Posterior refers to the back.
- Medial refers to a position closer to the midline.
- Lateral refers to a position farther from the midline.
- Superior refers to structures closer to the head.
- Inferior refers to structures closer to the feet.



Fig. 2.1: Anatomical position of body

In exercise settings, these terms help trainers give precise instructions. Instead of saying “move your arm outward,” a trainer may explain abduction away from the midline. Some students confuse anatomical position with relaxed standing posture. In relaxed standing, the palms usually face the thighs. In anatomical position, the palms face forward. This distinction is important because forearm rotation (supination and pronation) is defined relative to palm orientation in anatomical position. Another common error involves perspective. Movement description always relates to the individual’s body, not the observer’s viewpoint.

2. Importance for General fitness trainers

Anatomical position plays an essential role in fitness training by providing a standardised language for understanding and describing human movement. It enables general fitness trainers to accurately describe exercises, identify joint actions, correct posture and movement patterns effectively, and communicate clearly with other fitness and healthcare professionals.

Clear understanding reduces confusion and supports safe movement instruction. Anatomical position establishes the structural reference for all movement description. It defines orientation, supports consistent terminology and forms the basis for analysing exercise mechanics. Mastery of this concept strengthens a trainer’s ability to observe, instruct and correct movement with precision.

4. Fundamental Exercise Positions

Every exercise begins from a specific body position. The way a person positions the body before movement influences stability, muscle activation, joint alignment and overall safety. A clear understanding of starting positions allows trainers to analyse technique correctly and make appropriate corrections. Without recognising these

positions, it becomes difficult to identify movement errors or progression levels. Exercise positions provide stability, influence muscle activation and determine movement difficulty. These are as follows:

- (i) **Standing position:** The body is upright with weight supported by the feet. It is commonly used for squats, lunges and overhead presses and requires balance, lower-limb control and core stability (Fig. 2.2).
- (ii) **Sitting position:** Body weight is supported by a chair or bench, reducing balance demands. It is useful for exercises such as seated presses and rows (Fig. 2.3).

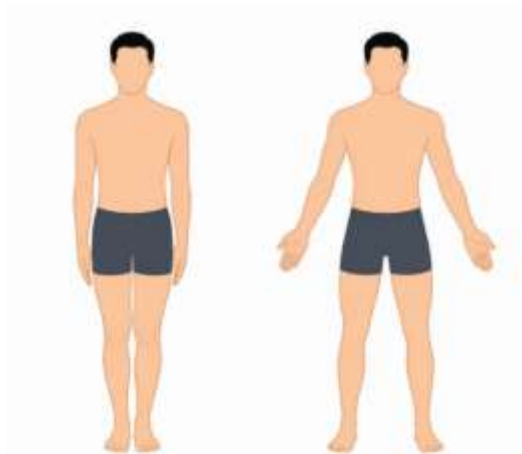


Fig. 2.2: Standing position



Fig. 2.3: Sitting position

- (iii) **Supine position:** The individual lies on the back facing upward (Fig. 2.4). It is commonly used for bench presses, crunches and glute bridges.
- (iv) **Prone Position:** The individual lies face down and performs exercises such as back extensions and core drills (Fig. 2.5).
- (v) **Kneeling Position:** Tall and half-kneeling positions challenge core stability, balance and hip control (Fig. 2.6).
- (vi) **Quadruped Position:** The body is supported by both hands and knees and is commonly used for bird-dog and mobility exercises (Fig. 2.7).



Fig. 2.4: Supine position



Fig. 2.5: Prone position



Fig. 2.6: Kneeling position



Fig. 2.7: Quadruped position

Fundamental exercise positions help trainers progress exercises according to a client's ability. Beginners may start with seated or supine exercises to develop control and stability. As ability improves, exercises can progress to kneeling and standing positions. For example, a shoulder press may begin in a seated position and later progress to standing to increase balance and stability demands. These positions help trainers adjust difficulty, load and movement quality.

5. Planes of Movement

Planes of movement are imaginary surfaces used to describe the direction of body movement (Fig. 2.8).

- (i) **Sagittal Plane:** Divides the body into right and left sections. It involves forward and backward movements such as flexion and extension. Squats, lunges and biceps curls mainly occur in this plane.
- (ii) **Frontal Plane:** Divides the body into front and back sections. It involves side-to-side movements such as abduction and adduction. Lateral raises and side lunges are examples.

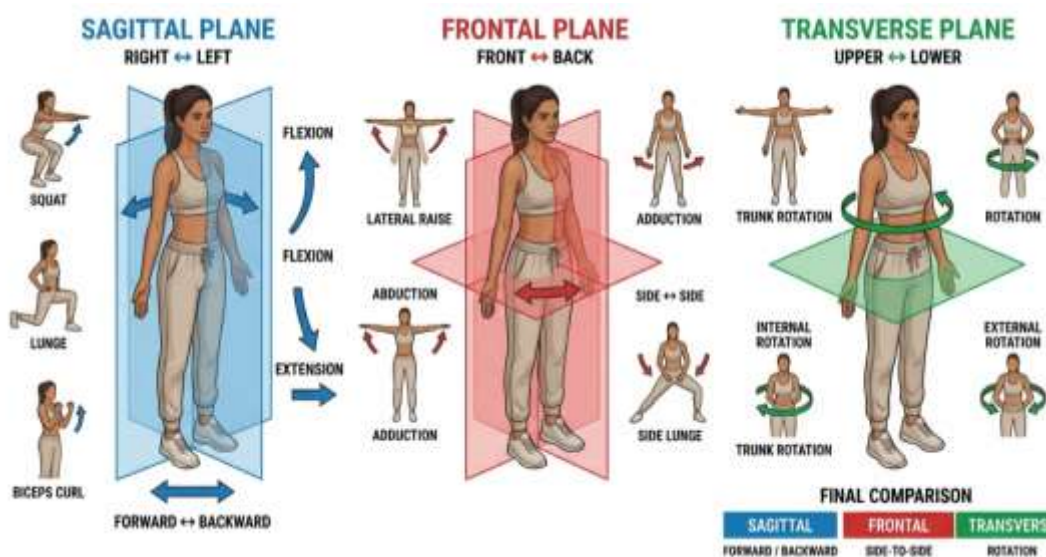


Fig. 2.8: Sagittal, frontal, and transverse planes of movement

- (iii) **Transverse Plane:** Divides the body into upper and lower sections. It involves rotational movements such as trunk rotation and internal or external rotation.

6. Combined Plane Movements

Some exercises involve more than one plane. For example, a diagonal lunge combines sagittal and frontal movements, while a tennis serve involves all three planes. Training across different planes promotes balanced movement and functional fitness. Understanding movement planes helps trainers analyse exercises, correct technique, select suitable exercises and develop balanced training programmes.

7. Axes of Movement

An axis is an imaginary line around which a joint move. Each axis is perpendicular to its corresponding plane. Different types of axes (Fig. 2.9) are as follows:

- (i) **Frontal (Mediolateral) axis:** Supports sagittal-plane movements such as squats and biceps curls.
- (ii) **Sagittal (Anteroposterior) axis:** Supports frontal-plane movements such as lateral raises.
- (iii) **Vertical (Longitudinal) axis:** Supports transverse-plane movements such as torso rotation.

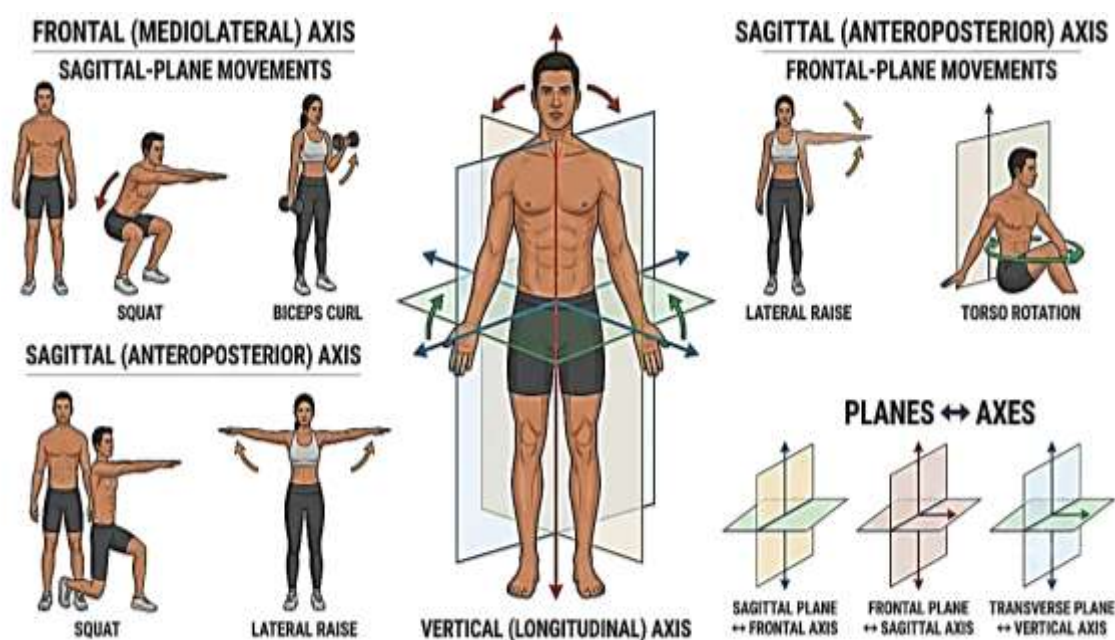


Fig. 2.9: Axes of movement

The relationship between planes and axes explains how body movements occur around specific axes. The sagittal plane works around the frontal axis, the frontal plane works around the sagittal axis, and the transverse plane works around the vertical axis. Understanding this relationship helps trainers analyse movements, correct technique and design safe and effective exercises.

Practical Exercise

Activity 1: Anatomical position and directional terms

Material Required:

1. Anatomy chart
2. Directional terms worksheet
3. Pen/pencil

Procedure:

- Stand in anatomical position.
- Identify anterior, posterior, medial, lateral, superior and inferior.
- Practise giving movement instructions using anatomical terms.
- Identify common errors in anatomical positioning.

Activity 2: Fundamental exercise positions

Material Required:

1. Exercise mat
2. Chair/bench
3. Anatomy chart
4. Pen/pencil

Procedure:

- Demonstrate standing and sitting positions.
- Practise supine and prone positions.
- Practise kneeling and quadruped positions.
- Identify suitable exercises for each position.
- Discuss how positions affect stability and exercise difficulty.

Activity 3: Planes and axes of movement

Material Required:

1. Anatomy/movement chart
2. Exercise cards
3. Exercise mat
4. Pen/pencil

Procedure:

- Identify the sagittal, frontal and transverse planes.
- Identify the frontal, sagittal and vertical axes.
- Perform exercises representing each plane.
- Match exercises with their planes and axes.
- Discuss combined-plane movements.

Check Your Progress

A. Multiple Choice Questions

1. What is kinesiology?
 - a) The study of nutrition
 - b) The study of human movement
 - c) The study of diseases
 - d) The study of body weight
2. Which position is used as the standard reference for describing body movements?
 - a) Supine position
 - b) Prone position
 - c) Anatomical position
 - d) Sitting position
3. Which plane divides the body into right and left sections?
 - a) Frontal plane
 - b) Transverse plane
 - c) Sagittal plane
 - d) Horizontal plane
4. Which exercise position involves lying face down?
 - a) Supine
 - b) Prone
 - c) Quadruped
 - d) Kneeling
5. Which axis supports movements occurring mainly in the transverse plane?
 - a) Frontal axis
 - b) Sagittal axis
 - c) Vertical axis
 - d) Mediolateral axis

B. Fill in the Blanks

1. _____ is the study of human movement and how body structures work together to produce movement.
2. In anatomical position, the palms of the hands face _____.
3. The _____ plane involves forward and backward movements such as flexion and extension.
4. The frontal plane involves _____-to-side movements such as abduction and adduction.
5. The transverse plane works around the _____ axis.

C. Subjective Questions

1. Demonstrate the anatomical position and explain the main alignment features to a client.
2. A client performs a squat. Identify the main plane of movement and explain why the exercise belongs to that plane.
3. What are lateral raises? Identify the plane and axis of movement involved and explain your answer.
4. What are different fundamental exercise positions to make the exercise easier?
5. Explain how understanding combined-plane movements can help a trainer correct technique.

What have you learned?

After completing this session, you will be able to:

- explain anatomical position and its importance in movement instruction;
- elaborate on fundamental exercise positions and their applications;
- identify the three planes and axes of movement;
- classify exercises according to planes and axes of movement; and
- demonstrate correct use of anatomical and movement terminology in exercise instruction.

Session 2: Muscles and Movement Basics

Every visible movement in the body results from muscle contraction. When a person bends the elbow, stands from a chair, or stabilises the spine during lifting, muscles generate the force required for that action. Without muscle activity, joints would remain motionless, and posture could not be maintained. This section provides an understanding of the muscles and their types, enabling general fitness trainers to develop a better understanding of muscle function, movement, exercise selection and training adaptations.

1. Muscles and Types

Human movement depends on specialised tissues that generate force through contraction. These tissues are collectively known as muscles. The human body contains three primary types of muscle tissue: skeletal muscle, cardiac muscle and smooth muscle. Each type contributes to physical functioning in a distinct manner. These are as follows:

(i) Skeletal muscle: Skeletal muscle attaches to bones through tendons and produces voluntary movement. It is called “skeletal” because it acts on the skeleton. When skeletal muscle contracts, it pulls on bones across joints, creating motion (Fig. 2.10).

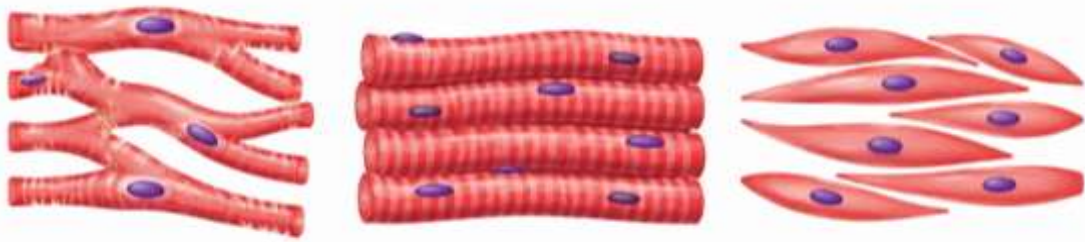


Fig. 2.10: Contraction of skeletal muscle

This muscle type operates under conscious control. A person decides to lift an arm, bend a knee, or hold a plank position. The nervous system sends signals from the brain to activate specific skeletal muscle fibres. In fitness training, skeletal muscle is the primary focus. Exercises such as squats, presses, rows and lunges directly target skeletal muscles. Strength development, hypertrophy, endurance and flexibility training all involve adaptation of skeletal muscle tissue. For example, during a push-up, several skeletal muscles contract simultaneously. The pectoralis major produces horizontal pressing force, the triceps brachii extends the elbow, and the core muscles stabilise the trunk. Coordinated skeletal muscle activity enables efficient performance.

(i) Cardiac Muscle: Cardiac muscle forms the muscular walls of the heart. Its function is to pump blood continuously throughout life. Unlike skeletal muscle, cardiac muscle does not operate under voluntary control. The heart contracts automatically through specialised electrical conduction pathways. During exercise, cardiac muscle activity increases. Heart rate rises, and the force of contraction strengthens. This adjustment ensures that working skeletal muscles receive adequate oxygen and nutrients.

(ii) Smooth Muscle: Smooth muscle lines the walls of internal organs such as the stomach, intestines, blood vessels and airways. It also surrounds certain glands and ducts. This muscle type operates involuntarily and responds to signals from the autonomic nervous system. During exercise, smooth muscle plays a supportive role.

2. Relevance in Fitness Practice

When a client performs resistance training, skeletal muscle contracts to produce movement. Simultaneously, cardiac muscle increases heart rate to deliver oxygen. Smooth muscle adjusts blood vessel diameter to manage circulation. These coordinated actions demonstrate how all three muscle types support physical activity. Recognising the distinct roles of muscle types enables trainers to interpret exercise response more accurately. It also reinforces the connection between movement mechanics and physiological adaptation. Understanding muscle types forms the foundation for further study of muscle structure, fibre composition and neuromuscular coordination.

3. Skeletal Muscle Structure

Skeletal muscles produce voluntary movement and maintain posture. They attach to bones through tendons, which transmit force during contraction. Muscles are organised into bundles called fascicles, which contain individual muscle fibres. Inside each muscle fibre are myofibrils made of repeating units called sarcomeres. Sarcomeres contain the proteins actin and myosin, which slide past each other to create muscle contraction. When many fibres contract together, the muscle produces movement.

4. Classification of Muscle Fibres

Skeletal muscle does not function as a single uniform tissue. Within the same muscle, individual fibres differ in speed, strength and resistance to fatigue. These differences influence how a person performs during endurance exercise, strength training, or explosive activity. When a client feels fatigue during long-distance running but performs well in short sprints, muscle fibre characteristics partly explain this variation. For a general fitness trainer, understanding muscle fibre types helps connect exercise intensity with physiological response (Fig. 2.11).

Muscle fibres are classified according to contraction speed and method of energy production. On this basis, they are broadly grouped into Type I fibres and Type II fibres, which are as follows:

- i) **Type I Fibres:** Slow-twitch fibres contract slowly, produce less force, resist fatigue and mainly use aerobic energy. They support endurance activities and posture.
- ii) **Type II Fibres:** Fast-twitch fibres contract quickly, produce greater force and fatigue faster. They are mainly used for speed, power and high-intensity activities.

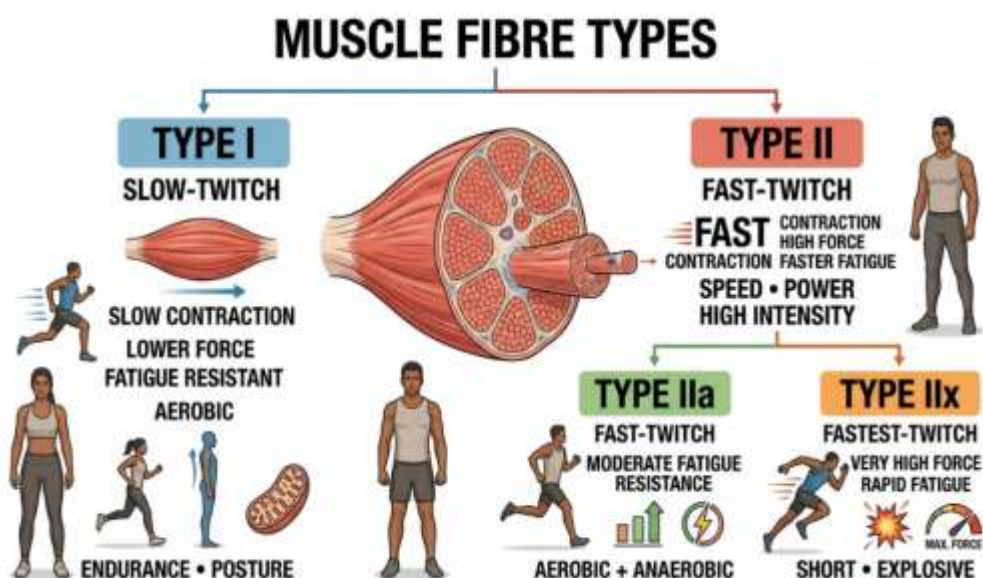


Fig. 2.11: Types of muscle fibre

- **Type IIa Fibres:** Type IIa fibres contract quickly, produce moderate-to-high force and have moderate fatigue resistance. They use both aerobic and anaerobic energy.
- **Type IIx Fibres:** Type IIx fibres contract fastest, produce very high force and fatigue quickly. They mainly support short, explosive activities.

5. Recruitment of Muscle Fibres

The body activates muscle fibres in a specific order. Type I fibres are recruited first during low-intensity activity. As exercise intensity increases, Type II fibres are gradually recruited to produce additional force. For example, during light cycling, slow-twitch fibres remain active. During a sprint finish, fast-twitch fibres become necessary. This sequential recruitment ensures efficient use of energy and prevents early fatigue during low-intensity work.

6. Influence of Training

Training improves the performance of muscle fibres according to the demands placed on them. Endurance training enhances the fatigue resistance and aerobic capacity of Type I fibres, while strength and power training increase the force and power output of Type II fibres. Although muscle fibre distribution is largely influenced by genetics, regular training improves the efficiency and function of all fibre types. Understanding these differences helps general fitness trainers design programmes that support specific goals such as endurance, strength, or power development.

7. Neuromuscular Coordination

Muscles do not work on their own. Every movement begins with a signal from the nervous system. The brain sends instructions through the spinal cord and nerves to the muscles. The muscles respond by contracting. The quality of this communication determines how smooth, stable and controlled a movement appears. This interaction between nerves and muscles is called neuromuscular coordination.

In fitness training, strength alone does not guarantee good movement. A person may have strong muscles but still perform an exercise with poor control. Efficient coordination (Fig. 2.12) allows the body to use strength effectively and safely. For general fitness trainers, understanding neuromuscular coordination is essential because exercise quality depends not only on force production but also on how accurately that force is applied.

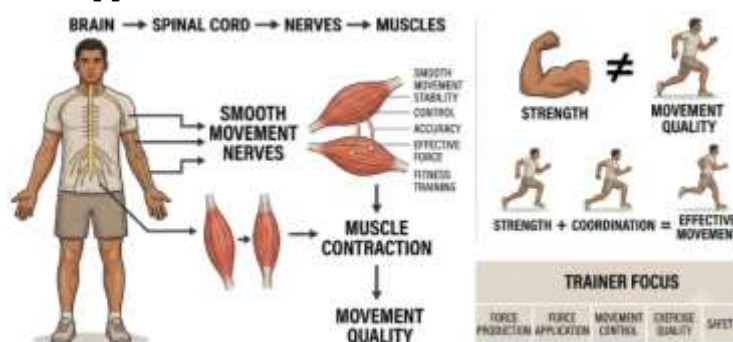


Fig. 2.12: Muscle fibre types helps to performs exercise, training or activity

8. Interaction Between Agonists, Antagonists and Stabilisers

Effective movement requires cooperation among different muscle groups. The agonist produces the primary movement. The antagonist controls the opposite movement and prevents excessive motion. Stabilisers maintain joint alignment and posture. During a push-up, the chest and triceps muscles act as agonists to extend the elbows and push the body upward. The back muscles help maintain shoulder stability. The abdominal muscles stabilise the trunk. If stabilisers fail to activate properly, the body may compensate by altering posture. Such compensation can increase joint stress and reduce efficiency.

9. Timing and Movement Sequencing

Correct timing is a critical component of neuromuscular coordination. Muscles must activate in a specific order to produce efficient movement. During a squat, the trunk stabilising muscles should engage before the legs generate force. This activation protects the spine and allows efficient transfer of force through the lower limbs. If stabilisation occurs late, excessive strain may occur. In activities such as running or jumping, rapid and coordinated activation of multiple muscle groups determines performance quality.

10. Role of Sensory Feedback and Proprioception

Neuromuscular coordination depends on sensory feedback. Receptors in muscles, tendons and joints detect changes in position and tension. These receptors send information to the brain. The brain processes this information and adjusts muscle activation accordingly. This awareness of body position is known as proprioception. It allows a person to maintain balance and adjust posture without conscious effort.

Practical Exercise

Activity 1: Identification of muscle types

Material Required:

1. Muscle anatomy chart
2. Muscle type pictures
3. Worksheet
4. Pen/pencil

Procedure:

- Identify skeletal, cardiac and smooth muscles.
- Discuss the function of each muscle type.
- Identify examples of activities involving skeletal muscles.
- Record the main differences between the three types.

Activity 2: Muscle fibre types and recruitment

Material Required:

1. Muscle fibre chart
2. Exercise cards

3. Worksheet
4. Pen/pencil

Procedure:

- Identify Type I and Type II muscle fibres.
- Compare their speed, force and fatigue resistance.
- Match exercises with appropriate muscle fibre types.
- Discuss muscle fibre recruitment during increasing exercise intensity.
- Record the effects of endurance and strength training.

Activity 3: Neuromuscular coordination

Material Required:

- Exercise mat
- Resistance band
- Exercise cards
- Observation sheet
- Pen/pencil

Procedure:

- Perform a basic movement such as a squat or push-up.
- Identify the agonist, antagonist and stabiliser muscles.
- Observe movement control and body alignment.
- Practise maintaining balance and posture.
- Discuss the role of proprioception and sensory feedback.

Check Your Progress

A. Multiple Choice Questions

1. Which type of muscle is primarily responsible for voluntary movement?
 - a) Cardiac muscle
 - b) Smooth muscle
 - c) Skeletal muscle
 - d) Visceral muscle

2. Which muscle fibre type is most resistant to fatigue and mainly uses aerobic energy?
 - a) Type I
 - b) Type IIa
 - c) Type IIx
 - d) Fast-twitch fibres

3. What is the main function of an agonist muscle during movement?
 - a) To produce the primary movement
 - b) To prevent all movement
 - c) To maintain blood pressure
 - d) To control digestion

4. What does neuromuscular coordination refer to?
 - a) The relationship between bones and joints only
 - b) The interaction between the nervous system and muscles
 - c) The digestion of nutrients
 - d) The production of hormones
5. What is proprioception?
 - a) The ability to produce maximum muscle force
 - b) Awareness of body position and movement
 - c) The ability of muscles to grow
 - d) The process of producing energy

B. Fill in the Blanks

1. Skeletal muscles attach to bones through _____.
2. Muscle fibres contain myofibrils made up of repeating units called _____.
3. Type I muscle fibres are also known as _____-twitch fibres.
4. Type IIx fibres are mainly used for short and _____ activities.
5. Muscles that maintain joint alignment and posture are called _____.

C. Subjective Questions

1. A client performs a push-up. Identify the main agonist muscles, antagonist muscles and stabilisers involved in the movement.
2. A client is training for a long-distance running event. Which muscle fibre type is particularly important for endurance, and how could the trainer design training to support its development?
3. Which muscle fibre types are particularly relevant for sprinting and jumping, and what types of exercises could the trainer use?
4. Explain how neuromuscular coordination and stabiliser activation may affect the client's movement.
5. Explain how proprioception and sensory feedback contribute to movement control and how the trainer could safely improve the client's coordination.

What have you learned?

After completing this session, you will be able to:

- explain the three types of muscle tissue and their functions;
- elaborate on skeletal muscle structure and muscle fibre types;
- identify the roles of agonists, antagonists and stabilisers;
- classify muscle fibres according to their characteristics and functions; and
- demonstrate understanding of neuromuscular coordination and proprioception in exercise.

Session 3: Energy Systems and Exercise Response

Exercise physiology explains how the body responds and adapts to physical activity and provides a foundation for designing safe and effective fitness programmes. Since muscles require energy to contract, understanding how the body produces and uses energy is essential for understanding exercise performance. The immediate source of energy for muscle contraction is ATP.

1. ATP: The Body's Immediate Energy Currency

ATP (Adenosine Triphosphate) is the immediate energy source used by muscles. When ATP is broken down, it releases energy for muscle contraction. Because muscles store only a small amount of ATP, the body must continuously regenerate it through three major energy systems. Trainers need to understand this process to match exercise demands with appropriate training and recovery.

2. Three Major Energy Systems

The three energy systems work together to provide ATP during exercise. Their contribution varies according to the intensity and duration of activity. These energy systems are as follows (Fig. 2.13):

(i) ATP-PC / Phosphagen System: The phosphagen system produces energy very rapidly without oxygen. It is dominant during short, explosive activities such as sprinting, jumping, throwing and heavy weightlifting. Trainers should use brief work periods and sufficient recovery when developing power.



Fig. 2.13: Working of phosphagen, anaerobic glycolytic and aerobic systems

(ii) Anaerobic Glycolytic System: This system rapidly produces energy by breaking down carbohydrates without relying directly on oxygen. It contributes significantly during high-intensity activities lasting several seconds to around two minutes, including repeated sprints and intense circuits. Trainers should carefully manage work-to-rest ratios because fatigue develops quickly.

(iii) Aerobic / Oxidative System: The aerobic system uses oxygen to produce ATP from carbohydrates and fats. It supports prolonged activities such as walking, jogging, cycling and endurance training. Trainers can use aerobic exercise to improve cardiovascular fitness and recovery capacity.

3. Comparing and Combining Energy Systems

The systems differ in their energy-production rate, duration, fuel sources and oxygen requirements. However, they work simultaneously, with one becoming dominant according to exercise demands. Trainers should therefore avoid viewing them as completely separate systems.

4. Exercise Intensity and Energy Demand

Low-intensity exercise relies mainly on the aerobic system, moderate activity combines aerobic and anaerobic contributions, while high-intensity exercise increasingly depends on the ATP-PC and anaerobic glycolytic systems. Understanding these responses helps trainers select appropriate exercise intensity, duration, volume and rest intervals, allowing programmes to target endurance, strength, power, or overall fitness safely and effectively.

Practical Exercise

Activity 1: Identify the three energy systems

Material Required:

1. Activity cards
2. Chart paper
3. Marker pens

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group cards showing activities such as sprinting, jumping, repeated sprints, jogging, cycling and walking.
- Ask students to classify the activities under ATP-PC/Phosphagen, Anaerobic Glycolytic and Aerobic/Oxidative systems.
- Groups discuss the intensity, duration and oxygen requirement of each activity.
- Each group presents its classification to the class.
- Discuss that all three energy systems work together, although one may be dominant depending on the activity.

Activity 2: Energy system and exercise intensity

Material Required:

1. Stopwatch
2. Cones

3. Activity cards
4. Recording sheet
5. Pen or pencil

Procedure:

- Divide the class into groups.
- Each group performs three activities: a 10-second sprint, 30–60 seconds of high-intensity exercise and 2–3 minutes of jogging/walking.
- Students observe their breathing, fatigue and recovery after each activity.
- Record the observations on the recording sheet.
- Identify the energy system mainly involved in each activity.
- Discuss how increasing exercise intensity changes the body's energy demand.

Activity 3: Comparing energy systems

Material Required:

1. Chart paper
2. Marker pens
3. Activity cards
4. Stopwatch
5. Pen or pencil

Procedure:

- Divide the class into three groups and assign one energy system to each group.
- Group 1 studies the ATP-PC/Phosphagen system, Group 2 the Anaerobic Glycolytic system and Group 3 the Aerobic/Oxidative system.
- Each group identifies the rate of energy production, duration, fuel source, oxygen requirement and examples of activities related to its system.
- Each group prepares a short chart based on these points.
- Groups present their charts to the class.
- Compare all three systems and discuss how they work together during exercise.

Check Your Progress

A. Multiple Choice Questions

1. What is the immediate energy source used by muscles for contraction?
 - a) Glucose
 - b) ATP
 - c) Fat
 - d) Oxygen
2. Which energy system is dominant during short, explosive activities such as jumping and heavy weightlifting?
 - a) Aerobic system
 - b) Anaerobic glycolytic system

- c) ATP-PC system
 - d) Oxidative system
3. Which energy system produces ATP using oxygen?
 - a) ATP-PC system
 - b) Anaerobic glycolytic system
 - c) Aerobic system
 - d) Phosphagen system
 4. Which type of activity relies mainly on the aerobic energy system?
 - a) Heavy weightlifting
 - b) Short sprinting
 - c) Long-distance jogging
 - d) Explosive jumping
 5. During high-intensity exercise, which energy systems increasingly contribute to ATP production?
 - a) ATP-PC and anaerobic glycolytic
 - b) Aerobic only
 - c) Aerobic and ATP-PC only
 - d) Anaerobic glycolytic only

B. Fill in the Blanks

1. ATP stands for Adenosine _____.
2. The _____ system produces energy very rapidly without oxygen.
3. The anaerobic glycolytic system primarily breaks down _____ to produce energy.
4. The aerobic system uses _____ to produce ATP.
5. The three energy systems work _____ during exercise.

C. Subjective Questions

1. What is ATP and why must the body continuously regenerate it during exercise?
2. Name the three major energy systems and state one characteristic of each.
3. How does exercise intensity influence the contribution of different energy systems?
4. A general fitness trainer is designing a programme for a client who wants to improve explosive power through short sprints and jumps. Which energy system should be targeted, and how should the work and recovery periods be planned?
5. A client is preparing for prolonged jogging and endurance activities. Which energy system should the trainer primarily target, and what type of exercise would be appropriate?

What have you learned?

After completing this session, you will be able to:

- explain the role of ATP in muscle contraction;

- elaborate on the three major energy systems;
- classify exercises according to their dominant energy system;
- demonstrate how intensity and duration affect energy demands; and
- identify suitable energy systems for different fitness goals.

Session 4: Cardiorespiratory Response

Cardiorespiratory fitness is the ability of the heart, lungs, blood and muscles to work together efficiently during physical activity. The heart pumps blood, the lungs supply oxygen and remove carbon dioxide, and the blood transports gases to and from working muscles. A general fitness trainer needs to understand this system to design safe and effective cardiovascular workouts. This session deals with cardiorespiratory fitness in detail.

1. Structure and Function of the Heart

The heart is a muscular organ located in the chest, slightly towards the left side. It has four chambers: the right and left atria and right and left ventricles.

Valves control the direction of blood flow. Fig. 2.14 illustrates the major chambers, valves, and blood vessels of the heart, showing the flow of deoxygenated blood to the lungs through the pulmonary circulation and oxygenated blood to the body through the systemic circulation. Major blood vessels, including the arteries and veins, carry

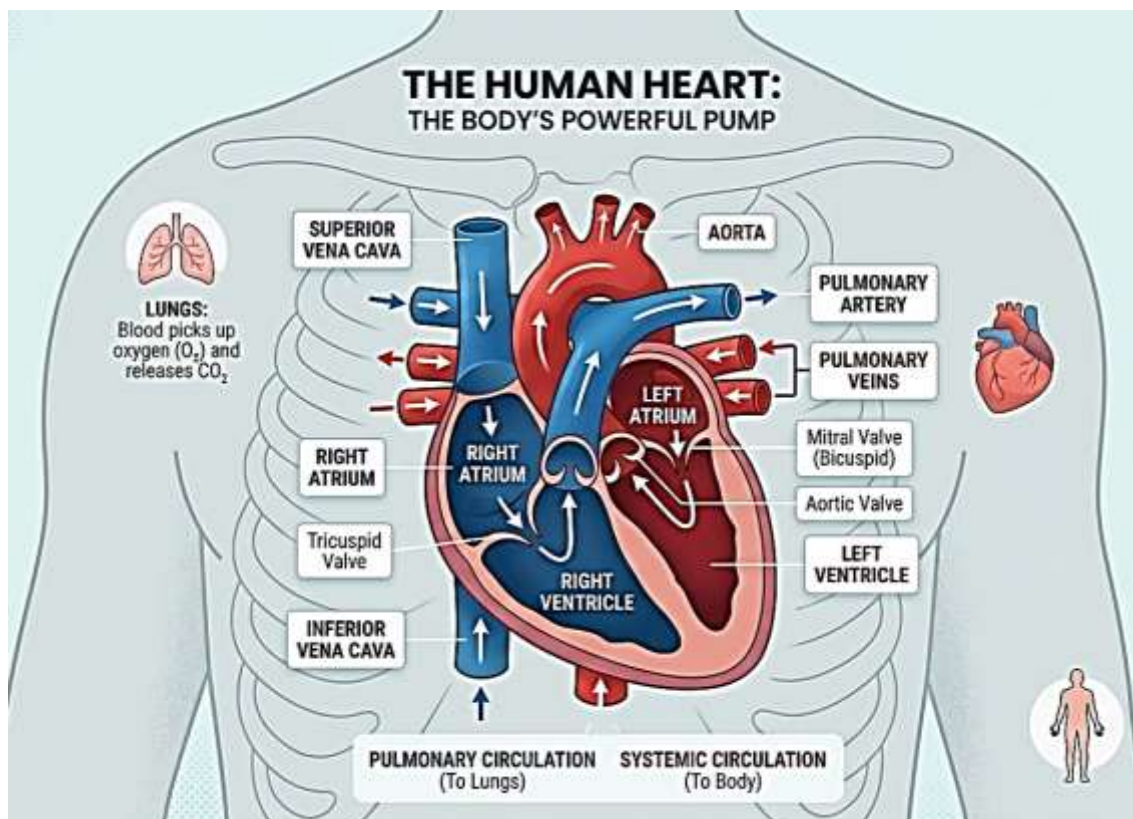


Fig. 2.14: Structure of the human heart and pathways of pulmonary and systemic circulation

blood to and from the heart. The main function of the heart is to pump blood throughout the body.

2. Blood Circulation

Blood circulation in humans is the continuous movement of blood throughout the body, carried out by the heart and blood vessels. The heart pumps blood to the lungs, where it receives oxygen and releases carbon dioxide. The oxygen-rich blood is then pumped to different parts of the body, supplying cells with oxygen and nutrients. The blood also collects carbon dioxide and other waste products from the cells and carries them back to the heart and lungs for removal. Thus, blood circulation plays an important role in maintaining the proper functioning of the body. Pulmonary

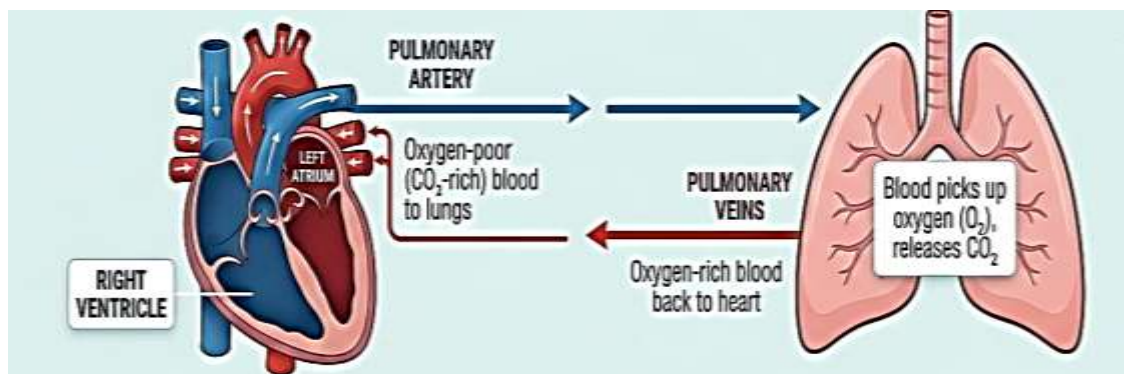


Fig. 2.15: Pulmonary circulation pathway

circulation carries oxygen-poor blood from the heart to the lungs and returns oxygen-rich blood to the heart (Fig. 2.15). Systemic circulation carries oxygen-rich blood from the heart to body tissues and returns oxygen-poor blood. During exercise, blood delivers oxygen and nutrients to working muscles and carries away carbon dioxide and other waste products.

3. Respiratory System and Gas Exchange

The respiratory system includes the nose, mouth, trachea, bronchi, lungs, alveoli and diaphragm. During inhalation, air enters the lungs and oxygen reaches the alveoli. Oxygen then passes into the blood, while carbon dioxide moves from the blood into the alveoli and is removed during exhalation.

4. Cardiovascular and Respiratory Responses to Exercise

During exercise, heart rate, stroke volume and cardiac output increase to supply more blood to working muscles. Blood flow is redistributed according to the body's needs. Breathing becomes faster and deeper, increasing oxygen uptake and carbon dioxide removal. Generally, higher exercise intensity produces greater increases in heart rate (Fig. 2.16) and breathing.

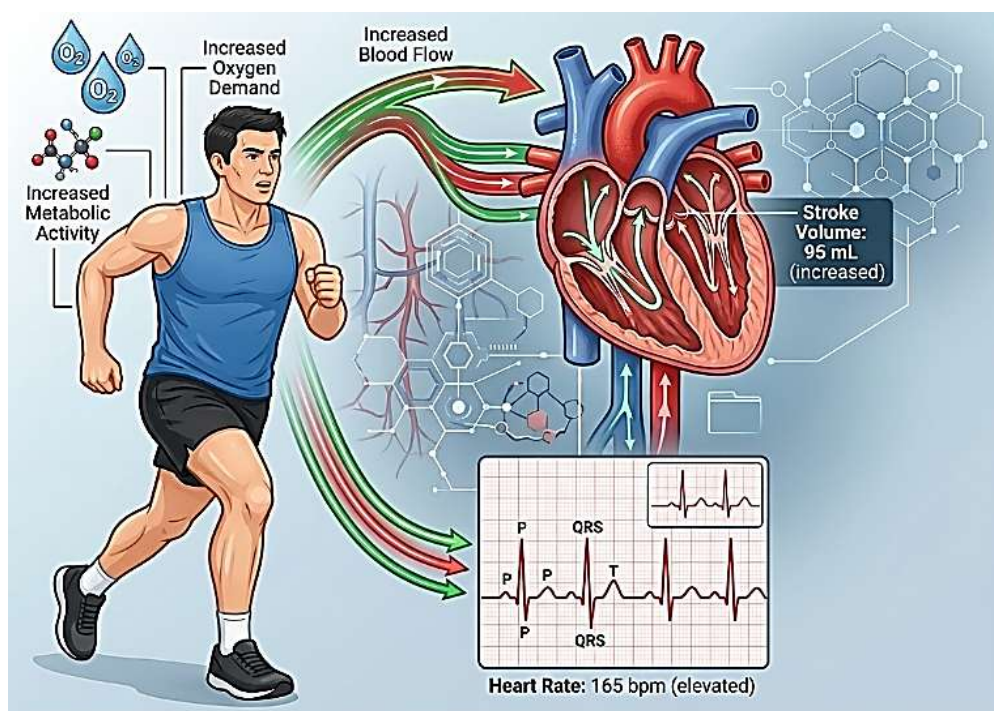


Fig. 2.16: Heart rate and stroke volume rises through exercises

5. Recovery and Cardiorespiratory Fitness

After exercise, heart rate and breathing gradually return to normal. Heart rate recovery reflects cardiovascular fitness and is influenced by intensity, fitness, age, hydration, temperature and rest. Regular aerobic exercise strengthens the heart, improves endurance, increases oxygen delivery and lowers resting heart rate. Monitoring these responses helps trainers control exercise intensity, recovery, safety, and long-term cardiovascular health.

6. Heart Rate Monitoring

Heart rate monitoring is an effective way to measure and regulate exercise intensity. As physical demand increases, heart rate rises to supply working muscles with oxygen and nutrients. Resting and maximum heart rates help establish training zones, while heart rate recovery indicates fitness and fatigue. Monitoring supports safe, effective cardiovascular training.

Practical Exercise

Activity 1: Trace the blood circulation pathway

Material Required:

1. Chart paper
2. Marker pens
3. Heart diagram
4. Coloured pencils
5. Activity cards

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a heart diagram and activity cards showing different parts of the circulatory system.
- Students arrange the cards to show the pathway of pulmonary and systemic circulation.
- Use different colours to show oxygen-rich and oxygen-poor blood.
- Each group labels the atria, ventricles, lungs, and major blood vessels.
- Groups present the completed pathway and explain the movement of blood.

Activity 2: Observe cardiovascular and respiratory responses to exercise**Material Required:**

1. Stopwatch
2. Exercise mat or open space
3. Recording sheet
4. Pen or pencil
5. Water bottle

Procedure:

- Divide the class into groups of 4–5 students.
- One student from each group records the resting heart rate and breathing rate of a participant.
- The participant performs light exercise such as jogging on the spot for 2 minutes.
- Immediately after exercise, record the heart rate and observe the breathing rate.
- Record the heart rate again after 1 minute and 2 minutes of recovery.
- Rotate the roles so that different students participate.
- Groups compare the results and discuss why heart rate and breathing increase during exercise and gradually decrease during recovery.

Activity 3: Heart rate monitoring and exercise intensity**Material Required:**

1. Stopwatch
2. Recording sheet
3. Pen or pencil
4. Open space
5. Heart rate monitoring device, if available

Procedure:

- Divide the class into groups of 4–5 students.
- Ask students to record their resting heart rate.

- Perform a low-intensity activity such as walking for 2 minutes and record the heart rate.
- After adequate rest, perform a moderate-intensity activity such as brisk walking or light jogging for 2 minutes and record the heart rate.
- Compare the resting, low-intensity, and moderate-intensity heart rates.
- Record the heart rate again during recovery.
- Discuss how heart rate can be used to monitor exercise intensity and how heart-rate recovery provides information about cardiorespiratory fitness.

Check Your Progress

A. Multiple Choice Question

1. What is cardiorespiratory fitness?
 - a) The ability to lift heavy weights
 - b) The ability of the heart, lungs, blood, and muscles to work together efficiently
 - c) The ability to perform flexibility exercises
 - d) The ability to maintain body temperature
2. How many chambers does the human heart have?
 - a) Two
 - b) Three
 - c) Four
 - d) Five
3. Which type of circulation carries oxygen-poor blood from the heart to the lungs?
 - a) Systemic circulation
 - b) Pulmonary circulation
 - c) Coronary circulation
 - d) Muscular circulation
4. Where does oxygen pass into the blood during gas exchange?
 - a) Trachea
 - b) Bronchi
 - c) Alveoli
 - d) Diaphragm
5. Which of the following generally increases during exercise?
 - a) Heart rate
 - b) Heart rate only during rest
 - c) Breathing becomes slower and shallower
 - d) Blood flow to working muscles decreases

B. Fill in the Blanks

1. The heart has _____ chambers.
2. The two upper chambers of the heart are called the right and left _____.
3. _____ circulation carries oxygen-rich blood from the heart to body tissues.
4. During inhalation, oxygen reaches the _____ in the lungs.
5. _____ recovery is an important indicator of cardiovascular fitness.

C. Subjective Questions

1. What is cardiorespiratory fitness, and why is it important for a fitness trainer?
2. Name the four chambers of the heart and state the main function of the heart.
3. What happens to heart rate, stroke volume, and breathing during exercise?
4. A general fitness trainer wants to monitor a client's cardiovascular exercise intensity during a jogging session. Which measure can the trainer use, and how can it help regulate the workout?
5. A client becomes fatigued after a cardiovascular workout. What factors should the trainer consider when planning the client's recovery and subsequent training session?

What have you learned?

After completing this session, you will be able to:

- explain the structure and function of the heart;
- elaborate on pulmonary and systemic circulation;
- classify the main parts of the respiratory system;
- demonstrate cardiovascular and respiratory responses to exercise; and
- identify the importance of heart-rate monitoring in training.

Unit 3 Health Screening and Fitness Assessment

Unit 3 on **Health Screening and Fitness Assessment** builds a strong foundation in exercise readiness, fitness assessment, readiness screening, and body composition awareness, supporting safe, personalised, and effective fitness training.

[1] **Exercise Readiness** deals with exercise readiness, health screening, physical and lifestyle factors, psychological preparedness, warning signs, precautions, and safe exercise planning for clients.

[2] **Fitness Assessment Components** covers fitness assessment, physical fitness components, assessment principles, influencing factors, and testing methods to guide safe, effective, and personalised training programmes.

[3] **Readiness Questionnaires** explains PAR-Q, readiness questionnaire structure, response interpretation, contraindications, medical referral, and safe exercise participation through effective screening.

[4] **Body Composition Awareness** covers body composition, its components, assessment methods, health implications, body image, ethical considerations, and using results to plan safe, effective training.

Session 1: Exercise Readiness

Exercise readiness refers to an individual's physical, psychological, and lifestyle preparedness to participate safely in exercise. A general fitness trainer needs to understand readiness because clients differ in fitness level, health status, experience, motivation, and limitations. Assessing readiness helps the trainer select appropriate exercises, intensity, and progression while reducing injury risk. The trainer incorporates this by discussing the client's health, activity level, previous exercise experience, goals, and limitations before starting training. This session explains the basics of exercise readiness to help trainers understand and apply it effectively.

1. Health Screening Before Exercise

Health screening involves collecting information about a client's health, medical history, physical activity, and risk factors before exercise (Fig. 3.1). It is important for trainers to identify conditions that may require exercise modification or professional referral.

The general fitness trainer should conduct an appropriate pre-exercise screening, discuss the responses with the client, and identify any concerns. Screening is particularly important for beginners, older adults, inactive individuals, and clients with health conditions or previous injuries.



Fig. 3.1: Pre-exercise health screening

2. Factors Affecting Exercise Readiness

Several factors influence exercise readiness and determine whether a person is physically and mentally prepared to participate safely and effectively in exercise. For

a general fitness trainer, understanding these factors is important for selecting suitable activities, adjusting training intensity, and providing individualised exercise programmes. These are as follows:

(i) Physical Factors: Fitness level, previous injuries, health conditions, pain, fatigue, and illness can affect exercise readiness. Trainers need to understand these factors to select safe and suitable exercises. They incorporate this knowledge through observation, basic fitness assessment, client feedback, exercise modification, and gradual progression.

(ii) Lifestyle Factors: Physical activity habits, sleep, recovery, nutrition, hydration, and sedentary behaviour influence exercise performance and recovery. Trainers should understand these factors to design realistic programmes. They can discuss the client's daily routine and adjust training demands according to activity and recovery patterns.

(iii) Psychological Factors: Motivation, stress, confidence, emotional well-being, and self-perception influence participation and adherence. Trainers should understand these factors to build confidence and encourage consistency. They can use positive communication, achievable goals, feedback, and gradual challenges. Fig. 3.2 illustrates how physical factors, lifestyle factors, psychological factors, and trainer-related factors collectively influence an individual's readiness to participate in exercise. It highlights the importance of fitness level, health status, sleep, nutrition, hydration, motivation, confidence, communication, achievable goals, feedback, and progressive training in promoting safe and effective exercise participation.



Fig. 3.2: Physical, lifestyle and psychological determinants of exercise readiness

Warning Signs and Exercise Precautions

This refers to the signs, symptoms, and safety measures that tell a person when exercise may be unsafe or when they should stop or modify an exercise. Trainers must recognise warning signs such as unusual pain, dizziness, fainting, severe

breathlessness, chest discomfort, illness, or excessive fatigue (Fig. 3.3). Understanding these signs helps trainers protect client safety and recognise when professional advice is required. Trainers should monitor clients before and during exercise, stop or modify activity when necessary, and progressively increase intensity as the client adapts.



Fig. 3.3: Warning signs and exercise precautions

Establishing Personal Exercise Readiness

The trainer should combine screening information, physical assessment, lifestyle factors, psychological readiness, and client goals to determine an appropriate starting point. One should practise client assessment, identifying limitations, setting realistic goals, selecting suitable activities, and developing safe introductory programmes through role-play, case studies, and practical sessions.

Practical Exercise

Activity 1: Exercise readiness assessment

Material Required:

1. Exercise readiness questionnaire
2. Pen or pencil
3. Recording sheet
4. Chart paper
5. Marker pens

Procedure:

- Divide the class into groups of 4–5 students.
- In each group, one student acts as the trainer and another as the client.
- The trainer asks questions about the client's fitness level, previous exercise experience, goals, health, injuries, sleep, and daily activity.

- Record the responses on the assessment sheet.
- Identify factors that may affect the client's readiness for exercise.
- Groups discuss whether the client is ready for exercise and what precautions should be taken.
- Rotate the roles so that different students get an opportunity to act as trainer and client.

Activity 2: Identify warning signs and exercise precautions

Material Required:

1. Situation cards
2. Chart paper
3. Marker pens
4. Recording sheets

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group situation cards describing different exercise conditions, such as dizziness, chest discomfort, unusual pain, severe breathlessness, excessive fatigue, or feeling normal during exercise.
- Groups classify each situation as “Continue”, “Modify/Rest”, or “Stop Exercise and Seek Professional Advice”.
- Students write the appropriate precaution for each situation.
- Each group presents its answers to the class.
- Discuss why trainers should monitor clients before and during exercise.

Activity 3: Develop a personal exercise readiness plan

Material Required:

1. Case-study cards
2. Assessment worksheet
3. Chart paper
4. Marker pens
5. Pen or pencil

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a case study of a client with different fitness levels, goals, lifestyle habits, and limitations.
- Identify the client's physical, lifestyle, and psychological factors.
- Groups identify any precautions or limitations mentioned in the case.
- Based on the information, students select suitable beginner-level activities and an appropriate exercise intensity.
- Each group prepares a simple exercise readiness plan.
- Groups present their plans and explain how they would make the programme safe and suitable for the client.

Check Your Progress

A. Multiple Choice Questions

1. What does exercise readiness refer to?
 - a) Only an individual's physical fitness
 - b) An individual's physical, psychological, and lifestyle preparedness for exercise
 - c) Only an individual's motivation to exercise
 - d) The ability to perform high-intensity exercise
2. What is the main purpose of health screening before exercise?
 - a) To increase exercise intensity
 - b) To identify health conditions and risk factors
 - c) To measure body weight only
 - d) To select competitive athletes
3. Which of the following is a physical factor affecting exercise readiness?
 - a) Motivation
 - b) Sleep
 - c) Previous injury
 - d) Self-perception
4. Which of the following is a psychological factor affecting exercise readiness?
 - a) Hydration
 - b) Motivation
 - c) Fitness level
 - d) Previous injury
5. Which of the following is a warning sign that may require stopping or modifying exercise?
 - a) Normal sweating
 - b) Mild increase in breathing
 - c) Chest discomfort
 - d) Increased motivation

B. Fill in the Blanks

1. Exercise readiness includes physical, psychological, and _____ factors.
2. Health screening collects _____ about a client's health, medical history, physical activity, and lifestyle factors.
3. Sleep, nutrition, hydration, and recovery are examples of lifestyle factors affecting _____ readiness.
4. Motivation, stress, and confidence are examples of _____ factors.
5. Trainers should recognise warning signs such as dizziness, fainting, chest discomfort, and severe _____.

C. Subjective Questions

1. What is exercise readiness, and why is it important for a general fitness trainer?
2. What are the three major categories of factors that affect exercise readiness?
3. What is the purpose of health screening before starting an exercise programme?
4. A new client reports previous injury, fatigue, poor sleep, and low motivation before starting a training programme. How should the trainer assess the client's exercise readiness and plan the initial training session?
5. During an exercise session, a client develops dizziness and chest discomfort. What should the trainer do, and why is recognising such warning signs important?

What have you learned?

After completing this session, you will be able to:

- explain the importance of exercise readiness;
- elaborate on health screening before exercise;
- classify the factors affecting exercise readiness;
- demonstrate appropriate responses to exercise warning signs; and
- identify an individual's personal exercise readiness.

Session 2: Fitness Assessment Components

Fitness assessment is the systematic measurement of a person's physical fitness using specific tests. For a general fitness trainer, understanding fitness assessment is important because it helps the trainer know the client's current fitness level, identify strengths and weaknesses, select suitable exercises, set realistic goals, and monitor progress safely. It also helps the trainer avoid inappropriate training that may increase the risk of injury. This session covers key topics related to fitness assessment to help trainers understand and apply assessment methods effectively.

1. Purpose of Fitness Assessment

The purpose of fitness assessment includes the following:

- (i) To establish a baseline level of fitness:** Assessment helps you determine the client's present fitness status before training begins. This baseline allows you to compare future results and track progress over time.
- (ii) To support goal setting:** Measured results help you set realistic and achievable goals. Instead of guessing, you can plan targets based on actual performance levels.
- (iii) To guide exercise selection:** Assessment findings help you choose suitable exercises. For example, low muscular endurance may require gradual

resistance training, while poor flexibility may require mobility-focused activities.

- (iv) **To determine safe intensity levels:** Cardiorespiratory and strength assessments help you decide appropriate starting intensity. This prevents overexertion and reduces the risk of injury.
- (v) **To identify strengths and weaknesses:** Assessment highlights areas that need improvement. It may reveal muscle imbalances, limited endurance, or reduced movement quality.
- (vi) **To monitor progress and programme effectiveness:** Periodic reassessment shows whether the training programme is producing desired results. It allows you to modify the plan when necessary.
- (vii) **To motivate the client:** Measurable performance improvements can increase confidence and encourage consistent participation.

2. Principles of Fitness Assessment

Fitness tests should have validity (measure what they are intended to measure), reliability (produce consistent results), objectivity (reduce personal bias), and standardisation (use the same procedure each time). Tests must also be safe and appropriate for the individual.

3. Factors Affecting Fitness Assessment Results

The results of a fitness assessment can be influenced by several individual, physical, environmental, and procedural factors. Understanding these factors is important because they may affect an individual's performance during testing and, consequently, the accuracy and interpretation of the results. A general fitness trainer should consider these factors when conducting assessments and comparing results over time. The major factors include the following:

- a) **Age:** Fitness levels and physical performance can vary with age and may influence test results.
- b) **Sex:** Physiological and physical differences between males and females may affect performance in certain fitness tests.
- c) **Training Status:** An individual's level of regular physical activity and training experience can significantly influence assessment results.
- d) **Fatigue and Rest:** Lack of adequate rest or testing immediately after strenuous activity may reduce performance and affect the results.
- e) **Nutrition:** Adequate nutrition supports energy availability and physical performance, whereas insufficient food intake may affect test performance.
- f) **Hydration:** Dehydration can affect endurance, strength, concentration, and overall physical performance.
- g) **Environmental Conditions:** Temperature, humidity, altitude, air quality, and the testing surface can influence performance, particularly during endurance-based tests.

- h) **Testing Procedure:** Differences in equipment, instructions, warm-up, timing, technique, or test conditions can affect the reliability of results. Therefore, standardised procedures should be followed as far as possible.
- i) **Motivation and Psychological State:** A person's motivation, confidence, concentration, anxiety, or willingness to exert effort can influence performance during testing.

4. Process of Fitness Assessment

Fitness assessment is an ongoing process used to understand an individual's current level of fitness and to plan an appropriate exercise programme. It helps establish a baseline, identify strengths and areas that need improvement, set realistic goals, select suitable exercises, determine safe exercise intensity, and monitor progress. Regular assessment also helps maintain motivation and ensures that the exercise programme remains safe, effective, and appropriate to the individual's needs.

The process of fitness assessment begins with assessing the individual's current fitness status and establishing a baseline. Based on the assessment findings, appropriate goals and exercises are selected, and a safe level of exercise intensity is determined. Progress is then monitored, and the programme is modified when necessary to support continued improvement and motivation.

- a) **Baseline Fitness:** Baseline fitness refers to the individual's initial level of fitness before beginning an exercise programme. It provides a starting point against which future changes and improvements can be measured. Assessing the present fitness status also helps identify areas that may require greater attention.
- b) **Goal Setting:** Fitness assessment helps in setting realistic, specific, and achievable goals according to the individual's needs, abilities, and fitness level. Clear goals provide direction and help the individual remain focused and motivated throughout the programme.
- c) **Exercise Selection:** The assessment findings guide the selection of appropriate exercises and physical activities. Exercises may be chosen to improve muscular strength and endurance, flexibility, mobility, cardiovascular fitness, or other areas identified during the assessment.
- d) **Safe Exercise Intensity:** Fitness assessment helps determine an appropriate and safe exercise intensity. The intensity should match the individual's current fitness level and gradually increase as fitness improves. Appropriate intensity helps prevent excessive fatigue, overexertion, and unnecessary risk of injury.
- e) **Identifying Strengths and Weaknesses:** Assessment helps identify the individual's strengths and areas requiring improvement, such as muscle imbalances, reduced flexibility, poor mobility, or inefficient movement

patterns. This information helps in designing a more balanced and effective exercise programme.

- f) **Monitoring Progress and Programme Effectiveness:** Regular monitoring and periodic reassessment help determine whether the exercise programme is producing the desired results. The programme can be modified or progressed according to the individual's improvement, changing needs, and performance.
- g) **Maintaining Motivation:** Seeing measurable improvements in fitness can increase confidence and motivation. Positive progress encourages regular participation and helps individuals remain committed to their exercise programme and long-term fitness goals.

Fig. 3.4 illustrates the process of fitness assessment as a continuous cycle.



Fig. 3.4: Fitness assessment in exercise programme planning

Fitness assessment helps establish a baseline, set goals, select suitable exercises, and determine safe intensity. Regular assessment also helps monitor progress, modify the programme, and maintain motivation.

Practical Exercise

Activity 1: Fitness assessment – Know your fitness level

Material Required:

1. Stopwatch
2. Exercise mat
3. Measuring tape
4. Weighing machine
5. Step/platform
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Record the height and weight of each group member.
- Perform a simple step test to assess cardiorespiratory endurance.
- Perform a push-up test to assess muscular endurance.
- Perform the sit-and-reach test to assess flexibility.
- Record the results of all group members.
- Compare the results and identify strengths and areas for improvement.
- Discuss suitable fitness goals based on the assessment.

Activity 2: Components of physical fitness

Material Required:

1. Chart paper
2. Markers
3. Stopwatch
4. Exercise mat
5. Activity cards
6. Notebook and pen

Procedure:

- Divide the class into groups of 5–6 students.
- Assign different components of physical fitness to each group.
- Discuss the meaning and importance of the assigned component.
- Select one suitable fitness test for the component.
- Demonstrate and perform the selected test safely.
- Record the observations on chart paper.
- Present the findings to the class.
- Discuss the importance of each fitness component in daily life and sports.

Activity 3: Fitness test circuit

Material Required:

1. Stopwatch
2. Exercise mats

3. Cones
4. Step/platform
5. Chair
6. Score sheet and pen

Procedure:

- Divide the class into groups of 5–6 students.
- Set up stations for push-ups, squats, plank hold, wall sit, and step test.
- Assign different roles such as performer, timer, observer, and scorer.
- Perform the activity at each station for the given time or repetitions.
- Rotate the groups until all students complete every station.
- Record the scores for each activity.
- Identify the fitness component tested at each station.
- Discuss individual strengths and areas that need improvement.

Check Your Progress

A. Multiple Choice Questions

1. What is the main purpose of fitness assessment?
 - a) To increase exercise intensity immediately
 - b) To determine an individual's current fitness level and guide exercise planning
 - c) To select only competitive athletes
 - d) To measure body weight only
2. Which principle of fitness assessment means that a test measures what it is intended to measure?
 - a) Reliability
 - b) Objectivity
 - c) Validity
 - d) Standardisation
3. Which of the following can affect fitness assessment results?
 - a) Hydration
 - b) Fatigue
 - c) Environmental conditions
 - d) All of the above
4. What is the purpose of establishing a baseline fitness level?
 - a) To compare future changes and track progress
 - b) To determine the client's age
 - c) To avoid reassessment
 - d) To increase training intensity

5. Why should fitness assessments be conducted using standardised procedures?
 - a) To make every test more difficult
 - b) To ensure results are more consistent and comparable
 - c) To reduce the need for exercise planning
 - d) To increase client motivation only

B. Fill in the Blanks

1. Fitness assessment helps establish a _____ level of fitness before training begins.
2. A test that measures what it is intended to measure has good _____.
3. The ability of a fitness test to produce consistent results is called _____.
4. Lack of adequate rest or strenuous activity before testing can cause _____ and affect the results.
5. Fitness assessment results can be influenced by factors such as age, nutrition, hydration, and _____.

C. Subjective Questions

1. What is fitness assessment? Explain its main purposes.
2. Describe the principles of fitness assessment.
3. Explain any five factors that can affect fitness assessment results.
4. Describe the process of fitness assessment from establishing a baseline to monitoring progress.
5. How does fitness assessment help a trainer design a safe and effective exercise programme?

What have you learned?

After completing this session, you will be able to:

- explain the purpose and importance of fitness assessment;
- identify the key principles of fitness assessment;
- describe the factors that can affect fitness assessment results; and
- describe the steps involved in the fitness assessment process.

Session 3: Readiness Questionnaires

A readiness questionnaire is a set of questions used to collect basic information about a person's health and readiness to participate in physical activity. For a general fitness trainer, it is an important initial screening tool because it helps identify possible health risks before exercise begins. Clients should answer honestly and accurately so the trainer can plan safe and suitable activities. This session covers key topics related to readiness questionnaires to help trainers understand their purpose, importance, and appropriate use.

1. Purpose of Physical Activity Readiness Questionnaire (PAR-Q)

The Physical Activity Readiness Questionnaire (PAR-Q) (Fig. 3.7) is a standard pre-exercise screening tool used to determine whether an individual can safely begin physical activity. It contains a set of simple health-related questions that focus on common medical conditions and warning signs. The following are the purposes of the questionnaire:

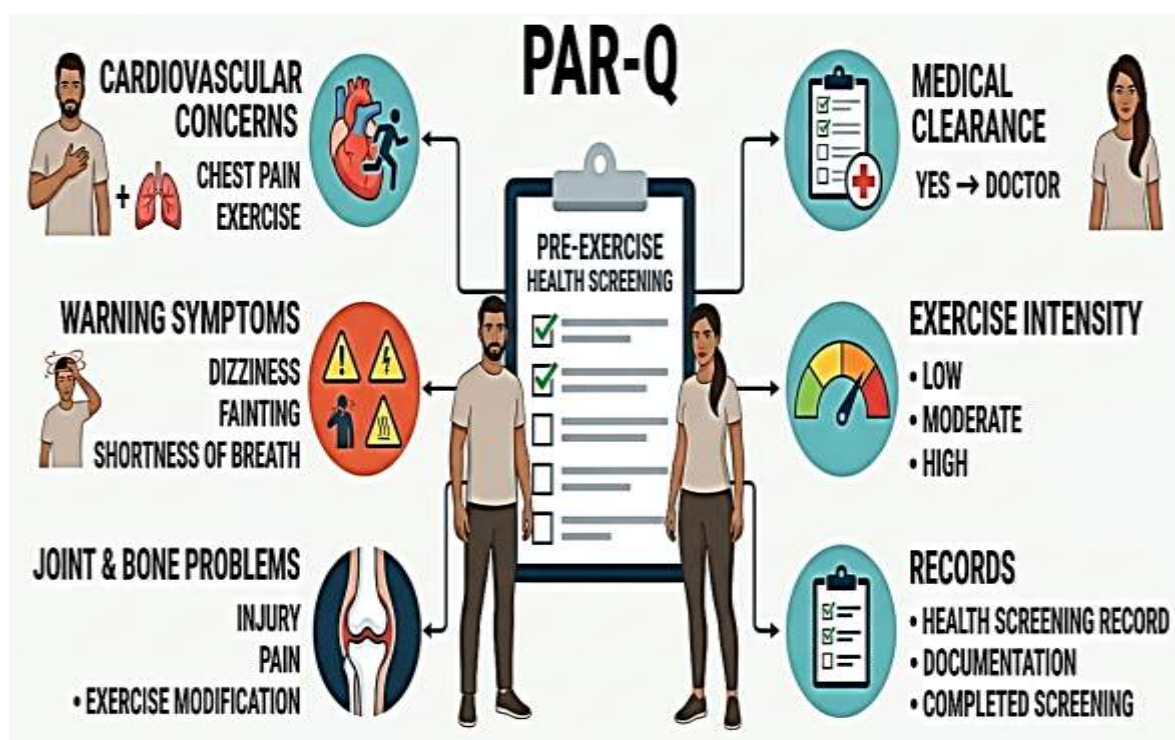


Fig. 3.7: PAR-Q-based pre-exercise screening process

- (i) **Screen for cardiovascular concerns:** Identifies heart-related symptoms, such as chest pain during exercise.
- (ii) **Detect warning symptoms:** Checks for dizziness, fainting, and unusual shortness of breath.
- (iii) **Identify joint or bone problems:** Helps identify injuries or pain that may require exercise modifications.
- (iv) **Determine need for medical clearance:** A “yes” answer may mean the client needs to see a doctor before exercising.
- (v) **Guide exercise intensity:** Helps decide whether low, moderate, or higher-intensity exercise is appropriate.
- (vi) **Maintain records:** Provides documentation that health screening was completed before exercise.

2. Structure of a Readiness Questionnaire

A readiness questionnaire generally includes personal information, physical activity history, medical and health history, symptoms or warning signs, previous injuries, current medications or health-related considerations, and lifestyle factors (Fig. 3.8). This information helps the trainer understand the client's background before starting an exercise programme.

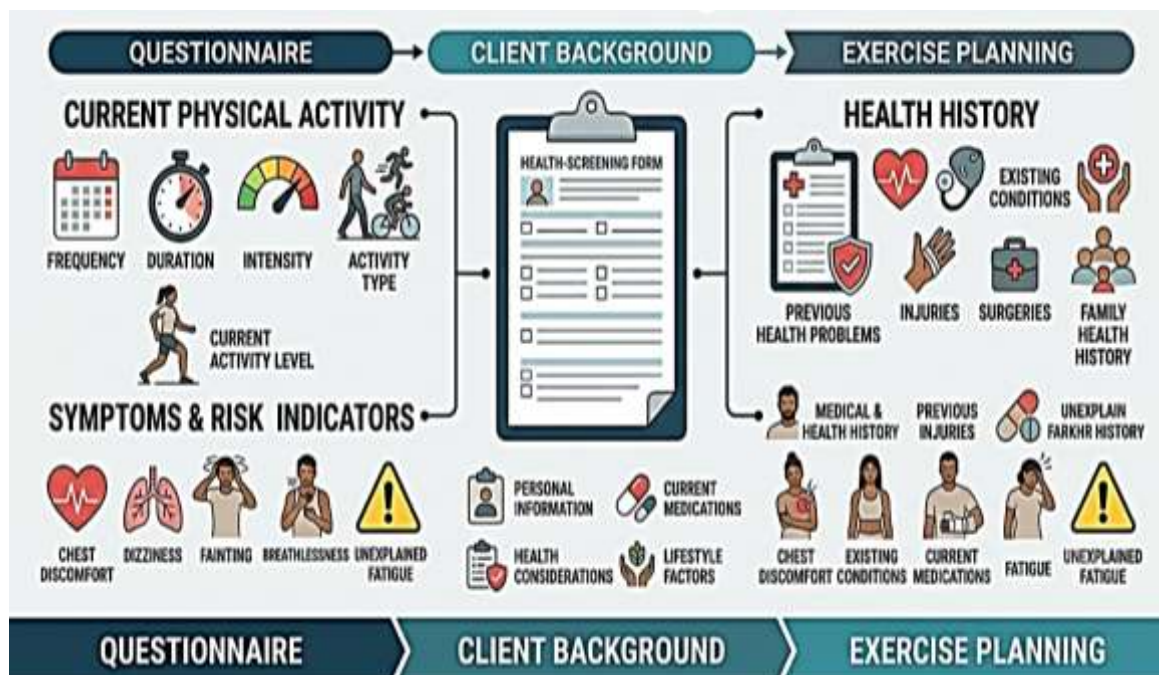


Fig. 3.8: PAR-Q-based pre-exercise screening process

Common areas covered in exercise readiness questionnaires are as follows:

- (i) Current Physical Activity:** Questions may cover how often a person exercises, how long they exercise, the intensity of activity, and the types of physical activities they perform. This helps the trainer understand the client's current activity level.
- (ii) Health History:** The questionnaire may ask about previous health problems, existing conditions, injuries, surgeries, and relevant family health history. This information helps the trainer identify factors that may affect exercise participation.
- (iii) Symptoms and Risk Indicators:** Questions may identify symptoms such as unusual chest discomfort, dizziness, fainting, unusual breathlessness, or unexplained fatigue. Such symptoms may require further professional attention before exercise.

3. Understanding the Questionnaire Response

A 'yes' response may indicate a potential risk factor that needs further consideration, while a 'no' response generally indicates that the reported concern is absent. However, questionnaires are screening tools and do not diagnose medical conditions. Further professional assessment may be appropriate when concerns are identified.

4. Applying a Readiness Questionnaire

A general fitness trainer should help the client complete the questionnaire as accurately as possible, review the responses, identify possible areas of concern, and decide appropriate next steps. If a significant concern is identified, the trainer should recommend seeking advice from an appropriate healthcare professional before beginning or changing exercise.

5. Understanding Questionnaire Responses

Collecting responses through a readiness questionnaire is only the first step. You must analyse and interpret the answers carefully before allowing the client to begin exercise. Each response provides important information about the client's health status and possible limitations. Careful review helps you make safe and responsible decisions. When reviewing questionnaire responses, follow these steps:

- (i) **Check 'Yes' answers:** Pay attention to symptoms such as chest pain, dizziness, heart problems, joint issues, or medications.
- (ii) **Ask follow-up questions:** Get more details about the reported health problem or symptoms.
- (iii) **Assess the risk:** Decide whether the issue is minor or requires medical clearance.
- (iv) **Observe the client:** Notice signs of discomfort, hesitation, or uncertainty.
- (v) **Decide the next step:** You may:
 - Proceed with low-intensity exercise
 - Modify the exercise programme
 - Delay exercise
 - Request medical clearance
 - Refer the client to a healthcare professional
- (vi) **Document findings:** Record important responses, clarifications, and recommendations.
- (vii) **Stay within your role:** Do not diagnose medical conditions. Identify risks and act safely within your professional scope.

6. Identifying Contraindications

Contraindications are health conditions that may prevent or limit exercise, such as chest pain, uncontrolled blood pressure, dizziness, severe breathlessness, injuries, or unstable diabetes. These are mainly classified as:

- i) **Absolute contraindications** that require medical clearance before exercise.
- ii) **Relative contraindications** that may allow modified exercise with monitoring.

Always stop if serious symptoms appear, refer the client for medical advice when needed, and document your decision.

7. Ensuring Safe Participation in Exercise

Safe participation in exercise requires continuous attention and responsible supervision. You must apply the information collected during screening and assessment to create a training plan that matches the client's health status and fitness level. Safety is not limited to the first session. You must monitor and adjust exercise throughout the programme. To ensure safe participation, follow these structured steps (Fig. 3.9).

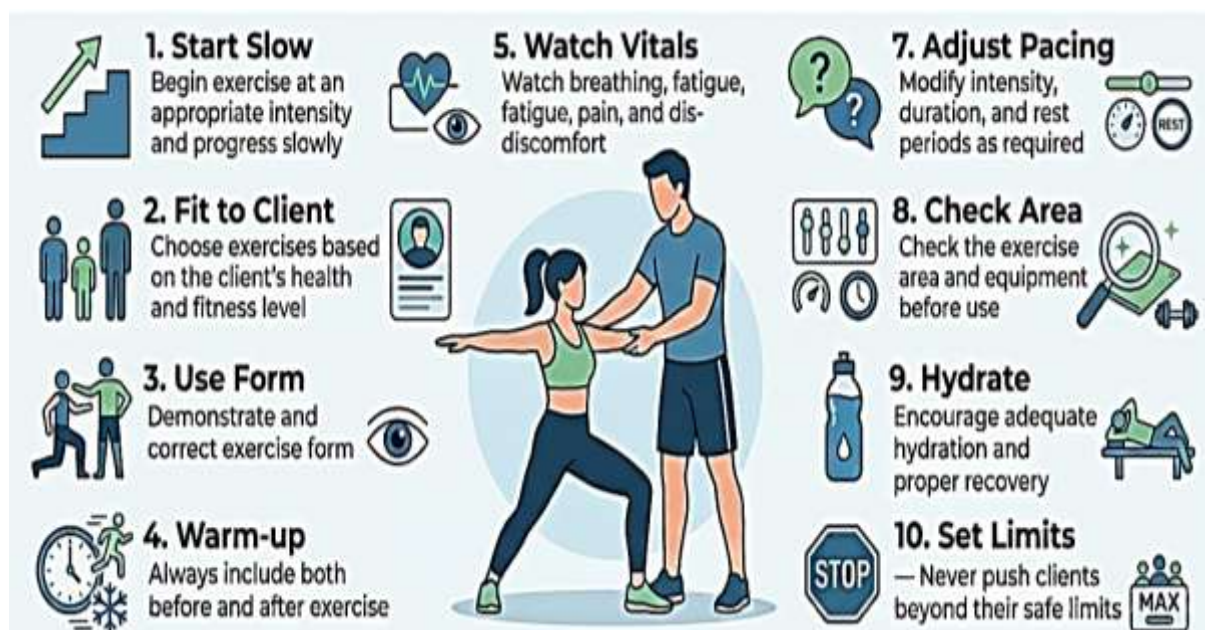


Fig. 3.9: Steps to ensure safe participation in exercise

Practical Exercise

Activity 1: PAR-Q screening activity

Material Required:

1. Printed PAR-Q forms
2. Pens
3. Clipboards
4. Health-screening scenario cards
5. Notebook

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a sample PAR-Q form and a scenario card.
- One student acts as the client and another as the general fitness trainer.
- The trainer asks the client the questions from the PAR-Q.
- The client gives appropriate Yes/No responses based on the scenario.
- The trainer identifies any health concerns or warning signs.

- Discuss whether the client can exercise, needs exercise modification, or requires medical clearance.
- Record the findings and explain the recommended next step.
- Rotate the roles so that all students participate.

Activity 2: Identify contraindications

Material Required:

1. Contraindication scenario cards
2. Chart paper
3. Markers
4. Pens
5. Notebook

Procedure:

- Divide the class into small groups.
- Give each group different health-related scenario cards.
- Read and discuss the condition mentioned on each card.
- Identify whether it may be an absolute or relative contraindication.
- Discuss the possible risks associated with exercise.
- Decide the appropriate action: proceed, modify, delay, or refer for medical advice.
- Write the group's decision on chart paper.
- Present the findings to the class.
- Discuss why a general fitness trainer should not diagnose medical conditions.

Activity 3: Safe exercise participation

Material Required:

1. Exercise mats
2. Stopwatch
3. Water bottles
4. Cones
5. Scenario cards
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Assign roles such as trainer, client, observer, and recorder.
- Give each group a different client scenario.
- The trainer selects suitable low- to moderate-intensity exercises based on the client's condition.
- Demonstrate proper exercise technique and warm-up.
- The observer monitors breathing, fatigue, pain, and discomfort.
- The trainer adjusts exercise intensity or rest periods when required.

- Perform a suitable cool-down after the activity.
- Record the safety measures followed by the group.
- Discuss how proper screening and continuous monitoring help ensure safe participation

Check Your Progress

A. Multiple Choice Questions

1. What is the full form of PAR-Q?
 - a) Physical Activity Readiness Questionnaire
 - b) Physical Assessment Readiness Questionnaire
 - c) Personal Activity and Risk Questionnaire
 - d) Physical Activity Risk and Quality
2. Which of the following symptoms may be identified through a readiness questionnaire?
 - a) Chest pain
 - b) Hair loss
 - c) Toothache
 - d) Skin colour
3. What may a 'yes' response to an important health-related question indicate?
 - a) The client is fully ready for exercise
 - b) A potential risk factor requiring further consideration
 - c) The client needs no supervision
 - d) The client should increase exercise intensity
4. Which type of contraindication requires medical clearance before exercise?
 - a) Relative contraindication
 - b) Temporary contraindication
 - c) Absolute contraindication
 - d) Minor contraindication
5. Which of the following should a trainer include to ensure safe participation in exercise?
 - a) Skipping the warm-up
 - b) Starting exercise at maximum intensity
 - c) Monitoring fatigue and discomfort
 - d) Ignoring client complaints

B. Fill in the Blanks

1. PAR-Q stands for Physical Activity Readiness _____.
2. A readiness questionnaire is an initial _____ tool before exercise begins.
3. A 'yes' response may indicate a potential _____ factor.

4. Contraindications are health conditions that may prevent or _____ exercise.
5. A trainer should include a _____ and cool-down to support safe participation.

C. Subjective Questions

1. Define PAR-Q and state any four purposes of using a readiness questionnaire.
2. List and explain any five common areas covered in an exercise readiness questionnaire.
3. What steps should a general fitness trainer follow when reviewing and interpreting questionnaire responses?
4. A new client reports dizziness and unusual breathlessness in the readiness questionnaire. Describe the steps you would take as a general fitness trainer before allowing the client to begin exercise.
5. Describe any five practical measures a general fitness trainer should follow to ensure safe participation during an exercise session.

What have you learned?

After completing this session, you will be able to:

- explain the purpose and importance of the PAR-Q;
- elaborate on the main sections of a readiness questionnaire;
- classify questionnaire responses and exercise contraindications;
- demonstrate the correct procedure for applying and reviewing a readiness questionnaire; and
- identify health risks and appropriate steps for ensuring safe exercise participation.

Session 4: Body Composition Awareness

Body composition refers to the proportion of different components that make up a person's body, mainly fat mass and fat-free mass. Body weight only tells us how much a person weighs, while body composition shows what that weight consists of. For a general fitness trainer, understanding body composition is important for setting realistic fitness goals and monitoring changes in muscle and body fat. This session covers the key concepts of body composition to help trainers understand its importance, assess it appropriately, and monitor changes effectively.

1. Components of Body Composition

Body composition is influenced by age, gender, genetics, nutrition, and physical activity, while regular exercise helps maintain muscle and control body fat. Understanding body composition enables fitness professionals to set realistic goals for fat loss, muscle development, and overall health, promoting safe and long-term fitness outcomes. A clear understanding of body composition involves identifying its

main components, which are broadly classified into fat mass and fat-free mass as follows (Fig. 3.10):

- i) **Fat Mass:** Fat mass includes essential body fat needed for normal body functions and storage fat used as an energy reserve. Healthy levels of body fat support hormone function, protection of organs, and energy storage.
- ii) **Fat-Free Mass:** Fat-free mass includes muscles, bones, body water, organs, and other tissues. Muscle mass is especially important for strength, movement, metabolism, and physical performance.

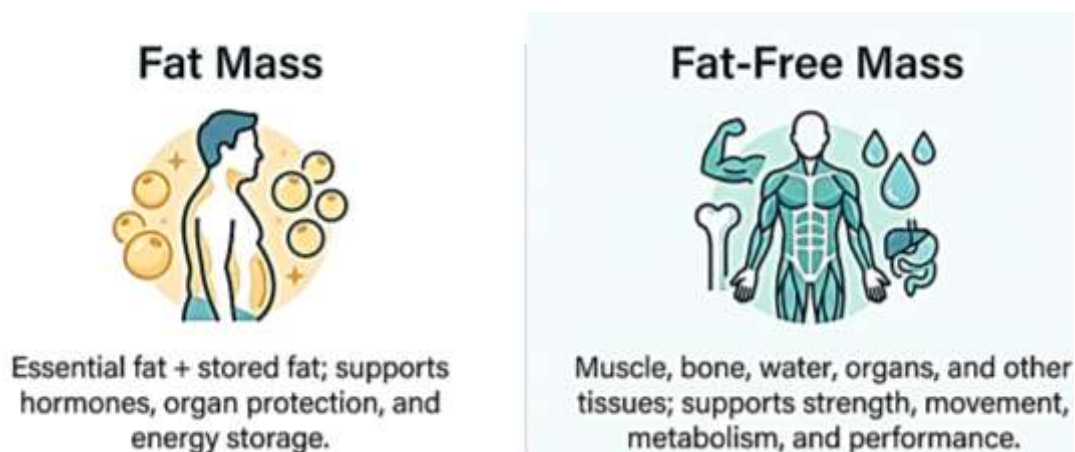


Fig. 3.10: Components of body composition

2. Body Composition and Health

Healthy body composition supports overall health and physical performance. Adequate muscle mass helps maintain strength and function, while healthy levels of body fat support normal body processes. Very high or very low body fat may be associated with health problems. A general fitness trainer should encourage a balanced approach rather than focusing only on body weight or appearance.

3. Methods of Assessing Body Composition

After understanding the concept of body composition, you must select appropriate methods to measure it. Different techniques provide different levels of accuracy, cost, and practicality. As a fitness professional, you should choose methods that are safe, reliable, and suitable for the client's needs and setting. Common body composition assessment methods include (Fig. 3.11):

- (i) **Body Mass Index (BMI):** BMI is calculated by dividing body weight in kilograms by height in metres squared. It provides a general indication of weight status but cannot distinguish muscle from fat, so it should not be used alone.
- (ii) **Waist Circumference:** Waist circumference measures abdominal size and can provide information about health risk associated with excess abdominal fat. It should be measured using a consistent procedure.

- (iii) **Skinfold Measurement:** Skinfold assessment uses a special instrument to measure the thickness of skinfolds at selected body sites. Correct technique and consistent measurement are important for reliable results.
- (iv) **Bioelectrical Impedance:** Bioelectrical impedance uses a small electrical current to estimate body composition. Readings can be affected by hydration, food intake, exercise, and other factors.

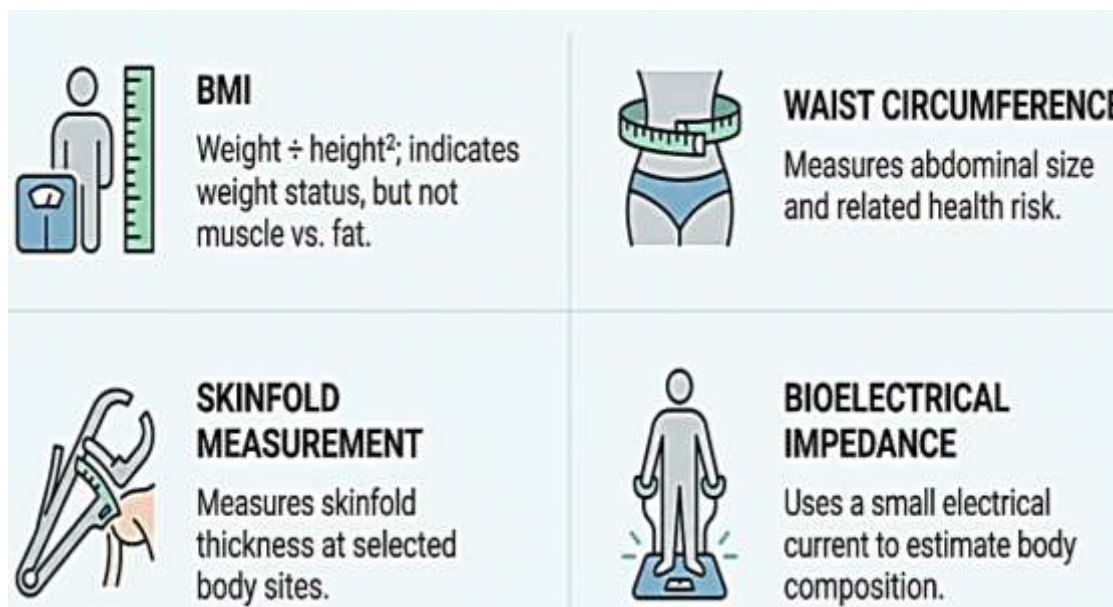


Fig. 3.11: Methods of assessing body composition

4. Limitations of Body Composition Measures

No single measurement gives a complete picture of body composition. Results can be influenced by muscularity, age, sex, hydration, and testing conditions. Trainers should interpret measurements carefully.

5. Healthy Body Composition Awareness

A healthy body composition can be supported through balanced nutrition, regular physical activity, strength training, cardiorespiratory exercise, adequate rest, recovery, and healthy lifestyle habits.

6. Body Image and Fitness

Body image refers to how a person views and feels about their body. General fitness trainers should promote healthy body perceptions, avoid unhealthy comparisons, recognise media influence, and respect individual differences.

7. Ethical Use of Results

Body composition results should be kept confidential and discussed respectfully, focusing on health rather than appearance. Trainers should set realistic goals, provide support, and refer clients when specialised advice is needed.

8. Using Findings for Safe Training

Assessment results should guide safe exercise selection, intensity, and progression according to individual needs. Gradual progression and regular reassessment help prevent injuries and support long-term fitness goals.

Practical Exercise

Activity 1: Body composition assessment

Material Required:

1. Weighing machine
2. Measuring tape
3. Height scale or measuring tape
4. Calculator
5. BMI chart
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Measure the height and body weight of each group member.
- Calculate BMI using the formula: $\text{BMI} = \text{Weight (kg)} \div \text{Height (m)}^2$.
- Measure waist circumference using a measuring tape and follow the same procedure for everyone.
- Record all measurements carefully.
- Compare the measurements and discuss what each measurement indicates.
- Discuss the limitations of BMI and why body weight alone cannot show body composition.
- Emphasise that results should be used for health and fitness planning, not appearance-based comparison.

Activity 2: Methods of body composition assessment

Material Required:

1. Measuring tape
2. Weighing machine
3. Calculator
4. Skinfold calliper
5. BMI chart
6. Sample bioelectrical impedance device, if available
7. Notebook and pen

Procedure:

- Divide the class into small groups.
- Assign each group one body composition assessment method.
- Discuss how the assigned method works and what it measures.

- Demonstrate the method using the correct procedure.
- Record sample results where appropriate.
- Discuss the advantages and limitations of the method.
- Compare the different methods in terms of accuracy, cost, and practicality.
- Each group presents its findings to the class.

Activity 3: Healthy body composition and lifestyle

Material Required:

1. Chart paper
2. Markers
3. Lifestyle scenario cards
4. Food and activity picture cards
5. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a lifestyle scenario card.
- Identify the habits that may support or negatively affect healthy body composition.
- Discuss the role of balanced nutrition, physical activity, strength training, cardiorespiratory exercise, sleep, and recovery.
- Prepare a simple healthy lifestyle plan for the given scenario.
- Include realistic and gradual fitness goals.
- Present the plan to the class.
- Discuss why body composition results should be used respectfully and confidentially, with the focus on health rather than appearance.

Check Your Progress

A. Multiple Choice Questions

1. Which two components broadly classify body composition?
 - a) Fat mass and fat-free mass
 - b) Muscle mass and bone mass
 - c) Water mass and bone mass
 - d) Fat mass and body weight
2. Which component of body composition includes muscles, bones, body water, and organs?
 - a) Fat mass
 - b) Storage fat
 - c) Fat-free mass
 - d) Essential fat

3. Which method calculates weight in kilograms divided by height in metres squared?
 - a) Skinfold measurement
 - b) Body Mass Index
 - c) Waist circumference
 - d) Bioelectrical impedance
4. Which method uses a special instrument to measure the thickness of skinfolds?
 - a) BMI
 - b) Waist circumference
 - c) Skinfold measurement
 - d) Bioelectrical impedance
5. How should body composition results be handled by a general fitness trainer?
 - a) Shared publicly
 - b) Discussed mainly in terms of appearance
 - c) Kept confidential and discussed respectfully
 - d) Used to compare clients

B. Fill in the Blanks

1. Body composition refers to the proportion of different _____ that make up the body.
2. _____ fat is needed for normal body functions.
3. Body Mass Index is commonly abbreviated as _____.
4. Bioelectrical impedance uses a small _____ current to estimate body composition.
5. Body composition results should be kept _____ and discussed respectfully.

C. Subjective Questions

1. Explain four common methods of assessing body composition.
2. State any five factors that can influence body composition or body composition assessment results.
3. Describe the procedure for measuring waist circumference, including the importance of consistent measurement conditions.
4. Explain how a general fitness trainer should use body composition assessment results to plan safe and appropriate training for a client.

What have you learned?

After completing this session, you will be able to:

- explain the concept and importance of body composition;
- elaborate on the main components of body composition;

- demonstrate safe and appropriate body composition assessment methods; and
- identify the limitations and ethical considerations of body composition assessment.

Unit 4 Exercise Science and Programme Design

Unit 4 on **Exercise Science and Programme Design** deals with a comprehensive foundation in exercise programme design, strength and endurance training, exercise mechanics, and goal-oriented planning for safe, effective, and individualised fitness training.

[1] **Structure of an Exercise Programme** covers exercise programme design, session components, FITT principles, training variables, exercise selection, sequencing, recovery, progression, and overload for effective training.

[2] **Strength and Endurance Principles** explains muscular strength, muscular and cardiorespiratory endurance, training principles, variables, methods, specificity, recovery, and progressive training for fitness development.

[3] **Exercise Mechanics** deals with exercise mechanics, force, resistance, stability, levers, joint movement, exercise analysis, and technique efficiency to improve performance and reduce injury risk.

[4] **Goal-Oriented Programme Planning** describes fitness goal setting, SMART goals, programme design, progression, monitoring, individualisation, safety, modification, and ethical practices for effective training.

Session 1: Structure of an Exercise Programme

An exercise programme is a planned set of physical activities designed to achieve specific fitness goals. For a general fitness trainer, systematic programme design is important for making exercise safe, effective, and suitable for each client. A trainer should consider the client's fitness level, age, goals, preferences, and limitations. Individualisation ensures that the programme is appropriate for the person. This session covers the key principles of exercise programme design to help trainers develop safe, effective, and individualised programmes based on each client's needs and goals.

1. Components of an Exercise Session

Several factors are taken into consideration when developing the exercise session, which are as follows (Fig. 4.1):

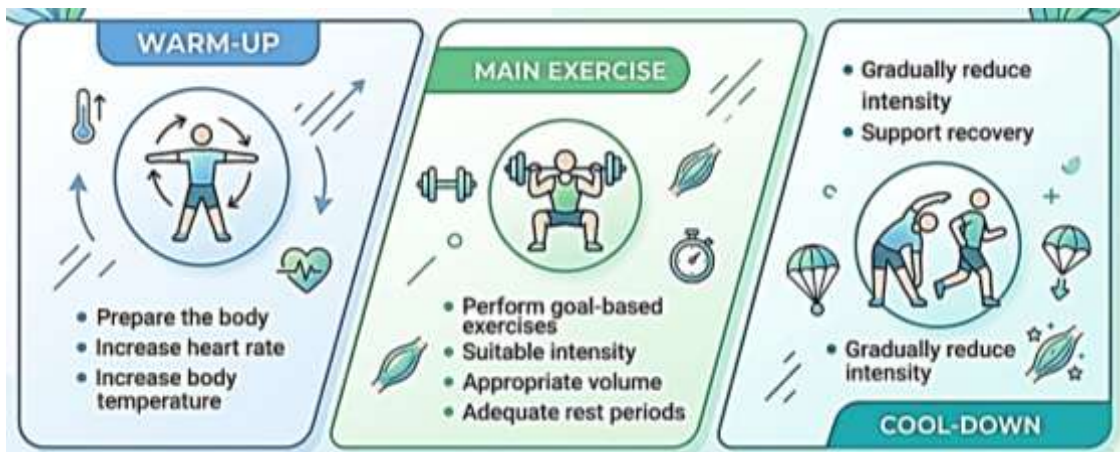


Fig. 4.1: Components of exercise session

- (i) **Warm-Up:** A warm-up prepares the body for exercise by gradually increasing heart rate, blood flow, and body temperature. It may include general activities such as light jogging, followed by activity-specific movements and mobility exercises.
- (ii) **Main Exercise Phase:** This is the main part of the session. The trainer selects appropriate exercises and decides their order, intensity, volume, and rest periods according to the client's goals.
- (iii) **Cool-Down:** Cooling down involves gradually reducing exercise intensity. It helps the body return towards its resting state and provides an opportunity for light movement and recovery activities.

2. FITT Principle

The FITT principle helps trainers organise an exercise programme in the following way:

- (i) **Frequency:** How often exercise is performed each week.
- (ii) **Intensity:** How hard the exercise is performed, which can be monitored using heart rate, effort level, or the talk test.
- (iii) **Time:** The duration of an exercise or training session.
- (iv) **Type:** The kind of exercise performed, such as aerobic, strength, flexibility, or skill-based activities.

3. Training Variables

Important training variables include exercise selection, exercise order, sets, repetitions, resistance, rest intervals, exercise duration, and training frequency. Trainers adjust these variables according to individual needs and goals.

4. Exercise Selection

Exercises should be selected according to the client's goals and ability. Compound exercises involve multiple muscle groups, while isolation exercises mainly target one

muscle group. Trainers may also select suitable cardiovascular, strength, mobility, and flexibility activities.

5. Exercise Order

Exercise sequencing refers to arranging exercises in a logical order based on the client's goals, intensity, complexity, and energy demands. Large muscle group, multi-joint, high-intensity, power, and skill-based exercises should generally be performed early. Alternating muscle groups can help manage fatigue. Proper sequencing improves performance, technique, safety, recovery, efficiency, and overall training effectiveness.

6. Rest and Recovery

Recovery allows the body to adapt to training. Trainers should provide suitable rest intervals between exercises and sessions. Excessive fatigue, reduced performance, persistent soreness, and lack of recovery may indicate excessive training load.

7. Progression and Overload

Progressive overload means gradually increasing the training demand so the body continues to adapt. This may involve increasing resistance, repetitions, duration, or frequency. Progression should be gradual and monitored to avoid excessive fatigue or injury.

Practical Exercise

Activity 1: Design an exercise session

Material Required:

1. Chart paper
2. Markers
3. Exercise mats
4. Stopwatch
5. Exercise cards
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a sample client profile with a specific fitness goal.
- Design a basic exercise session consisting of warm-up, main exercise phase, and cool-down.
- Select suitable exercises according to the client's goal and fitness level.
- Decide the duration, repetitions, sets, and rest periods.
- Arrange the exercises in a logical order.
- Write the complete session plan on chart paper.

- Demonstrate the session to the class.
- Discuss how the programme can be modified for different fitness levels.

Activity 2: Apply the FITT principle

Material Required:

1. FITT principle worksheet
2. Client scenario cards
3. Chart paper
4. Markers
5. Notebook and pen

Procedure:

- Divide the class into small groups.
- Give each group a different client scenario and fitness goal.
- Decide the Frequency of exercise per week.
- Select an appropriate Intensity using effort level or the talk test.
- Decide the Time or duration of each session.
- Select the appropriate Type of exercise.
- Complete the FITT plan on the worksheet.
- Present the plan to the class.
- Discuss how FITT can be adjusted according to individual needs.

Activity 3: Exercise selection, order and progression

Material Required:

1. Exercise cards
2. Chart paper
3. Markers
4. Stopwatch
5. Exercise mats
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a set of exercise cards.
- Select exercises according to a given fitness goal.
- Arrange the exercises in a logical sequence, placing demanding and complex exercises appropriately.
- Decide the number of sets, repetitions, resistance, and rest periods.
- Prepare a simple progression by gradually increasing repetitions, resistance, or duration.
- Explain why the selected order and progression are suitable.
- Present the exercise programme to the class.
- Discuss the importance of gradual progression and adequate recovery.

Check Your Progress

A. Multiple Choice Questions

1. Which phase of an exercise session prepares the body for physical activity?
 - a) Cool-down
 - b) Warm-up
 - c) Main exercise phase
 - d) Recovery
2. In the FITT principle, what does 'F' stand for?
 - a) Flexibility
 - b) Force
 - c) Frequency
 - d) Fitness
3. Which type of exercise mainly targets one muscle group?
 - a) Compound exercise
 - b) Isolation exercise
 - c) Aerobic exercise
 - d) Skill-based exercise
4. Which training principle involves gradually increasing training demand?
 - a) Individualisation
 - b) Recovery
 - c) Progressive overload
 - d) Exercise sequencing
5. Which exercises should generally be performed early in a training session?
 - a) Low-intensity stretching exercises
 - b) High-intensity and multi-joint exercises
 - c) Cool-down exercises
 - d) Recovery activities

B. Fill in the Blanks

1. The _____ phase gradually reduces exercise intensity at the end of a session.
2. In the FITT principle, _____ refers to how hard an exercise is performed.
3. The duration of an exercise or training session is referred to as _____.
4. Compound exercises involve _____ muscle groups.
5. Adequate _____ allows the body to adapt to training.

C. Subjective Questions

1. Describe an exercise programme and explain the three main components of an exercise session.
2. What is the FITT principle? Explain its four components.

3. Explain the importance of exercise order and sequencing in an exercise programme.
4. Design a basic exercise session for a beginner, including a warm-up, main exercise phase, and cool-down.
5. A client wants to gradually improve muscular strength. Explain how you would apply progressive overload by changing training variables such as resistance, repetitions, sets, or frequency.

What have you learned?

After completing this session, you will be able to:

- explain the purpose and components of an exercise programme;
- elaborate on the FITT principle and training variables;
- classify exercises according to type, muscle groups, and training goals;
- demonstrate proper exercise selection, sequencing, and progression; and
- identify the importance of rest, recovery, and progressive overload.

Session 2: Strength and Endurance Principles

Muscular strength is the ability of a muscle or muscle group to produce maximum force in one effort. Muscular endurance is the ability to perform repeated muscular contractions or maintain a contraction for an extended period. Strength focuses mainly on maximum force, while endurance focuses on sustaining or repeating effort. Both are important for daily activities, sports performance, posture, and overall fitness. This session covers the key concepts of muscular strength and endurance to help trainers understand their importance and apply appropriate training methods to improve both effectively.

1. Principles of Strength Training

Effective strength training follows important principles. Specificity means training according to the desired goal. Progressive overload involves gradually increasing training demand. Individualisation means adjusting exercise to the person's fitness level and needs. Recovery allows the body to repair and adapt, while variation helps prevent boredom and supports continued improvement.

2. Strength Training Variables

A general fitness trainer can modify resistance or load, repetitions, sets, rest periods, exercise selection, training frequency, and exercise tempo. These variables should be adjusted according to the client's goals, ability, and training experience.

(i) Developing muscular strength and endurance

Strength can be developed using an appropriate resistance and relatively lower-to-moderate repetitions. Adequate recovery between sessions is important. Trainers should apply progressive overload gradually while maintaining correct exercise technique and safety. Muscular endurance can be developed using relatively lower resistance and higher repetitions (Fig. 4.2). Suitable rest periods and circuit-style training can improve the ability of muscles to work repeatedly. Training should progress gradually according to the individual's capacity.

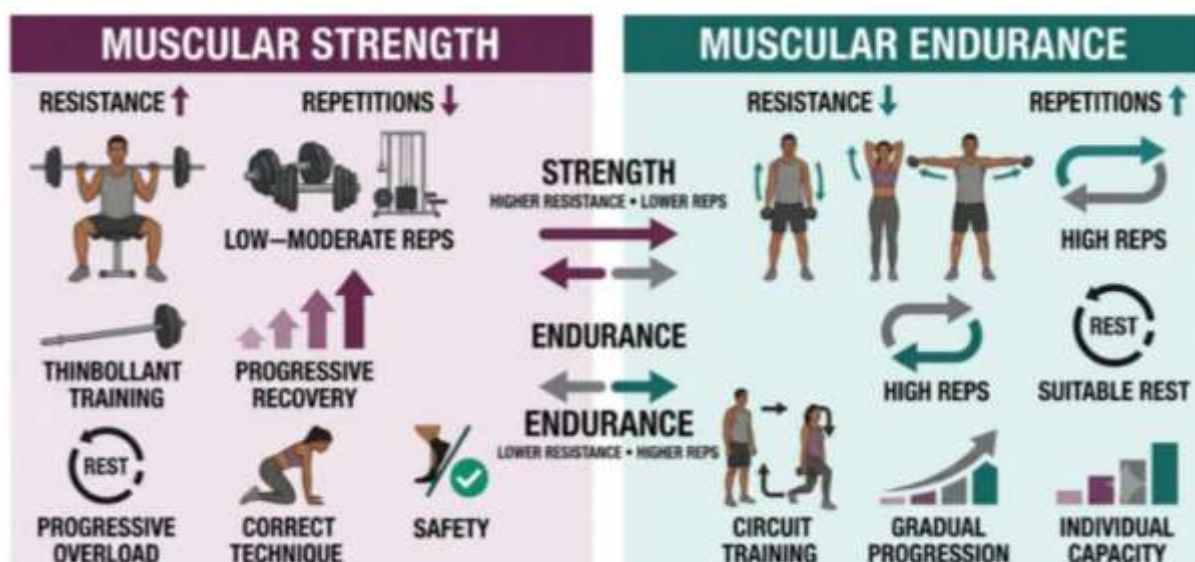


Fig. 4.2: Components of exercise session

3. Cardiorespiratory Endurance

Cardiorespiratory endurance is the ability of the heart, lungs, and circulatory system to support prolonged physical activity. Aerobic exercises such as walking, running, cycling, and swimming can improve endurance. Exercise duration, intensity, and weekly frequency should be planned according to the individual.

4. Methods of Endurance Training

Continuous training involves exercising at a steady intensity for a period of time. Interval training alternates periods of higher and lower intensity. Circuit training combines several exercises in sequence, while Fartlek-style training involves changes in speed or intensity. The method should match the fitness goal and ability.

5. Specificity of Training

Training should match the desired adaptation. A trainer should consider sport-specific requirements, whether the goal is strength or endurance, and the movements required for a particular activity. This makes training more relevant and effective. Recovery allows muscles and other body systems to repair and adapt to training. Adequate rest days, sleep, nutrition, and recovery strategies are important. Trainers

should monitor fatigue and avoid excessive training loads to reduce the risk of overtraining and injury.

Practical Exercise

Activity 1: Strength and muscular endurance circuit

Material Required:

1. Exercise mats
2. Stopwatch
3. Resistance bands
4. Light dumbbells
5. Cones
6. Score sheet and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Set up stations for squats, push-ups, lunges, resistance-band rows, plank, and jumping jacks.
- Assign one student as the performer and others as timer, observer, and recorder.
- Perform each exercise for a fixed time or number of repetitions.
- Rotate the students through all stations.
- Record the number of repetitions or time completed.
- Identify which exercises mainly develop muscular strength and which develop muscular endurance.
- Discuss the importance of correct technique, rest, and gradual progression.

Activity 2: Endurance training methods

Material Required:

1. Cones
2. Stopwatch
3. Whistle
4. Exercise mats
5. Score sheet
6. Notebook and pen

Procedure:

- Divide the class into small groups.
- Assign each group one endurance-training method: continuous, interval, circuit, or Fartlek.
- Discuss the main features of the assigned method.
- Plan a short activity based on the method.
- Perform the activity safely under teacher supervision.
- Record the duration, intensity, and rest periods.
- Compare the different training methods.
- Discuss which method is suitable for improving different types of endurance.

Activity 3: Principles of strength training

Material Required:

1. Exercise mats
2. Resistance bands
3. Light dumbbells
4. Exercise cards
5. Chart paper
6. Markers
7. Stopwatch

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a fitness goal or client profile.
- Select exercises according to the principle of specificity.
- Decide on suitable resistance, repetitions, sets, and rest periods.
- Develop a gradual progression using the principle of progressive overload.
- Include suitable recovery periods between training sessions.
- Add exercise variations to demonstrate individualisation and variation.
- Present the training plan to the class.
- Discuss how proper training principles improve performance while reducing the risk of excessive fatigue and injury.

Check Your Progress

A. Multiple Choice Questions

1. What is muscular strength?
 - a) Ability to maintain body balance
 - b) Ability of a muscle to produce maximum force in one effort
 - c) Ability to perform aerobic activity
 - d) Ability to stretch a muscle
2. Which principle means training according to the desired fitness goal?
 - a) Recovery
 - b) Variation
 - c) Specificity
 - d) Individualisation
3. Which training method alternates periods of higher and lower intensity?
 - a) Continuous training
 - b) Interval training
 - c) Circuit training
 - d) Fartlek training

4. Which type of training generally uses relatively lower resistance and higher repetitions?
 - a) Muscular endurance training
 - b) Maximum strength training
 - c) Power training
 - d) Speed training
5. Which of the following is important for recovery from strength training?
 - a) Avoiding sleep
 - b) Continuous training without rest
 - c) Adequate rest and nutrition
 - d) Increasing training load every day

B. Fill in the Blanks

1. Muscular _____ is the ability to perform repeated muscular contractions or maintain a contraction for an extended period.
2. Gradually increasing the training demand is known as progressive _____.
3. _____ training involves exercising at a steady intensity for a period of time.
4. Circuit training combines several _____ in sequence.
5. Adequate rest, sleep, nutrition, and recovery strategies help the body _____ and adapt to training.

C. Subjective Questions

1. State the main difference between muscular strength and muscular endurance.
2. Name and briefly explain the four methods of endurance training.
3. A beginner wants to improve cardiorespiratory endurance. Prepare a basic training plan using one suitable endurance-training method and explain how you would gradually progress the training.

What have you learned?

After completing this session, you will be able to:

- explain muscular strength, muscular endurance, and cardiorespiratory endurance;
- elaborate on the principles and variables of strength training;
- classify different methods of endurance training;
- demonstrate suitable methods for developing strength and endurance; and
- identify the importance of specificity, recovery, and progressive overload.

Session 3: Exercise Mechanics

Exercise mechanics is the study of how forces act on the body to move to exercise. Understanding mechanics helps a general fitness trainer teach correct technique, improve movement efficiency, and reduce the risk of injury. The relationship between

force and movement is important because the body must produce and control forces during every exercise.

1. Force and Resistance

Force is a push or pull that can change the movement of an object or body. Internal forces are produced by muscles, while external forces come from sources such as gravity, equipment, or resistance. Trainers should understand resistance to select suitable loads and teach safe movement. Resistance types are selected according to the client's goals, abilities, and training stage (Fig. 4.3). These are as follows:

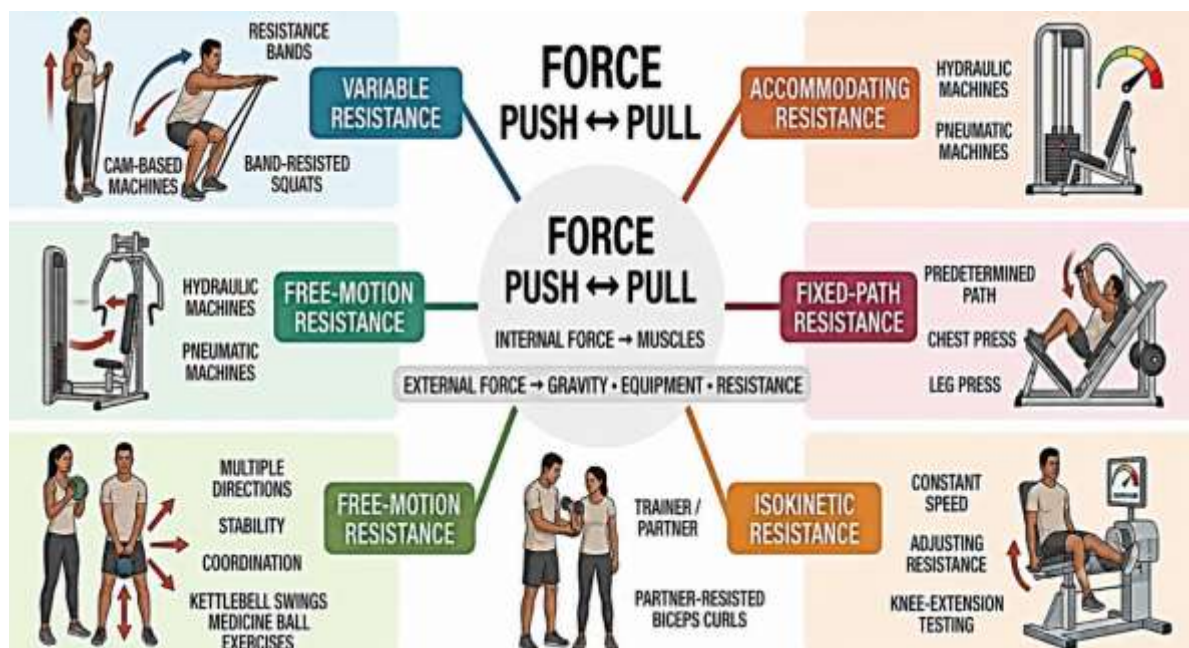


Fig. 4.3: Different forms of resistance used in strength and conditioning

- Variable resistance:** Resistance changes throughout the movement, as with resistance bands or cam-based machines. Example: Band-resisted squats.
- Accommodating resistance:** Resistance adjusts according to the force applied by the individual. Example: Hydraulic or pneumatic resistance machines.
- Fixed-path resistance:** The equipment guides movement along a predetermined path. Example: Chest press or leg press machines.
- Free-motion resistance:** Allows movement in multiple directions and requires greater stability and coordination. Example: Kettlebell swings or medicine-ball exercises.
- Manual resistance:** Resistance is applied and controlled by a trainer or partner. Example: Partner-resisted biceps curls.
- Isokinetic resistance:** Maintains a constant movement speed while adjusting resistance to the force applied. Example: Isokinetic knee-extension testing machines.

2. Centre of Gravity

The centre of gravity is the point where the body's mass is considered to be concentrated. Its position changes as the body moves. Understanding the centre of gravity helps a trainer improve balance and control during exercises.

3. Base of Support

The base of support is the area beneath and between the parts of the body in contact with the ground or another surface. A wider base generally provides greater stability, while a narrow base requires more balance and control. Changing body position can therefore affect stability.

4. Stability and Balance

Stability depends on factors such as the base of support, centre of gravity, body position, and control of movement. Trainers should teach clients to maintain suitable body positions and controlled movements to improve balance and exercise safety.

5. Levers in the Human Body

A lever is a rigid structure that moves around a fixed point called the fulcrum. The effort is the force produced by muscles, while the resistance is the load being moved. The human body commonly uses third-class levers during movements such as a biceps curl. A lever system includes three main components (Fig. 4.4):

- i) Fulcrum (F, pivot point): The joint where movement occurs.
- ii) Effort (E, force): The muscular force applied.
- iii) Load (L, resistance): The body part or external weight being moved.



Fig. 4.4: Components of lever system

Based on the relative positions of the fulcrum, effort, and load, levers are classified into three types:

- a) First-class lever: The fulcrum is between effort and resistance.
- b) Second-class lever: The resistance is between the fulcrum and effort.
- c) Third-class lever: The effort is between the fulcrum and resistance.

6. Joint Position and Movement Efficiency

Correct alignment, suitable range of motion, and appropriate joint positioning help make exercise movement efficient and safe. Trainers should encourage controlled movements and proper technique rather than using excessive speed or load.

7. Mechanical Analysis of Common Exercises

The mechanical analysis of common exercises focuses on understanding the key joints, muscles, movement patterns, alignment, and stability requirements involved in each exercise, as follows (Fig. 4.5):

- (i) **Squat:** A squat involves coordinated movement of the hips, knees, and ankles. Proper foot position, knee alignment, trunk control, and centre of gravity are important.
- (ii) **Push-Up:** A push-up requires controlled shoulder and elbow movement while maintaining a stable trunk. Hand position can influence the movement and muscle involvement.
- (iii) **Lunge:** A lunge requires lower-limb alignment and balance. Maintaining control of the centre of gravity helps the person perform the movement safely.
- (iv) **Biceps Curl:** A biceps curl mainly involves movement at the elbow joint. The resistance acts against the movement, while the biceps muscle produces the effort.

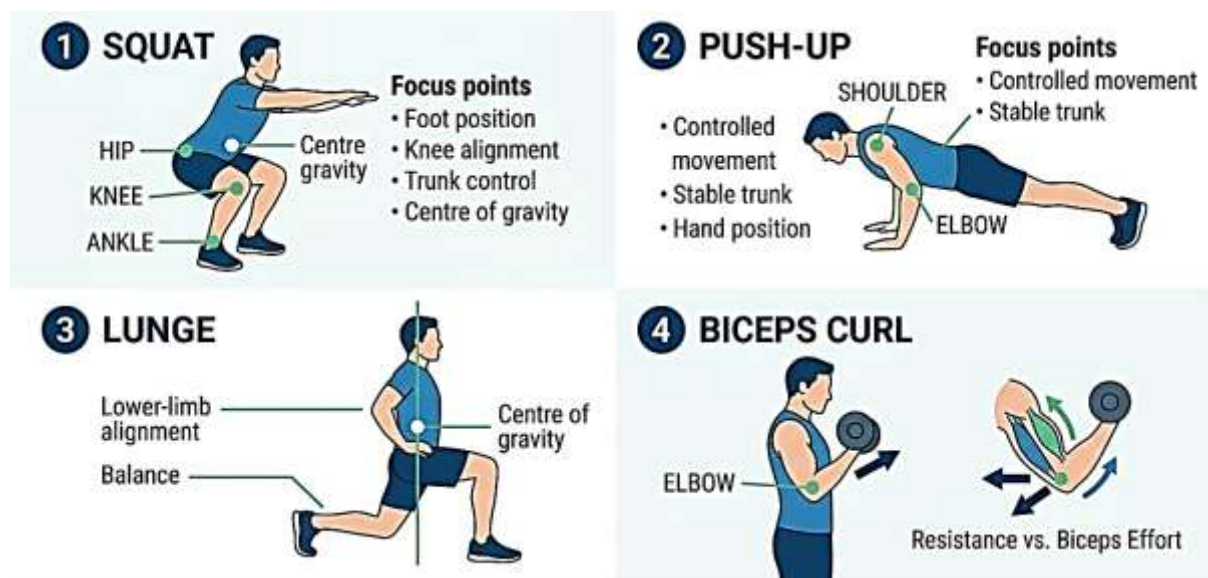


Fig. 4.5: Mechanical analysis of common exercise

8. Technique Efficiency and Common Technique Errors

Technique efficiency is the ability to perform an exercise with proper form, control, and effective muscle use. It involves correct posture, joint alignment, muscle activation, and breathing during movement. Efficient technique improves performance, reduces energy waste, and lowers the risk of injury. Technique efficiency involves proper alignment, controlled movement, appropriate range of motion, effective muscle recruitment, and correct breathing. Trainers should identify and correct common errors such as poor posture, instability, excessive movement, and poor load control to improve performance, safety, and training effectiveness.

Practical Exercise

Activity 1: Exercise mechanics

Material Required:

1. Exercise mats
2. Cones
3. Light dumbbells
4. Resistance bands
5. Stopwatch
6. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Ask students to perform simple movements such as squats, lunges, and standing balance.
- Observe how changing the base of support affects stability.
- Perform a squat with feet placed wide and then with feet placed closer together.
- Observe how the centre of gravity changes during different movements.
- Perform selected exercises using light resistance bands or dumbbells.
- Identify the force and resistance acting during each exercise.
- Discuss how proper body position and controlled movement improve stability and safety.

Activity 2: Mechanical analysis of common exercises

Material Required:

1. Exercise mats
2. Exercise cards
3. Light dumbbells
4. Resistance bands
5. Chart paper
6. Markers
7. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Assign each group one exercise: squat, push-up, lunge, or biceps curl.
- Perform the assigned exercise using correct technique.
- Identify the main joints involved in the movement.
- Identify the major muscles responsible for producing the movement.
- Observe the body alignment, range of motion, centre of gravity, and stability requirements.
- Identify any common technique errors.
- Discuss how the errors can affect movement efficiency and safety.
- Present the mechanical analysis to the class.

Activity 3: Understanding levers in the human body

Material Required:

1. Chart paper
2. Markers
3. Exercise cards
4. Light dumbbells
5. Exercise mats
6. Notebook and pen

Procedure:

- Divide the class into small groups.
- Explain the three parts of a lever: fulcrum, effort, and load.
- Assign each group one type of lever.
- Identify examples of the lever type in human body movements.
- Perform a biceps curl and identify the elbow as the fulcrum, muscle force as the effort, and weight as the load.
- Use exercise cards to identify first-, second-, and third-class lever examples.
- Prepare a simple diagram showing the position of the fulcrum, effort, and load.
- Present the diagrams and examples to the class.
- Discuss how understanding levers can help a trainer improve exercise technique and safety.

Check Your Progress

A. Multiple Choice Questions

1. What is a force?
 - a) A type of muscle
 - b) A push or pull that can change movement
 - c) A type of exercise
 - d) A body position
2. Which type of resistance guides movement along a predetermined path?
 - a) Free-motion resistance
 - b) Manual resistance
 - c) Fixed-path resistance
 - d) Variable resistance
3. What is the area beneath and between the parts of the body in contact with a surface called?
 - a) Centre of gravity
 - b) Base of support
 - c) Fulcrum
 - d) Resistance

4. In which type of lever is the effort positioned between the fulcrum and the load?
 - a) First-class lever
 - b) Second-class lever
 - c) Third-class lever
 - d) Fourth-class lever
5. Which exercise mainly involves movement at the elbow joint and uses the biceps to produce effort?
 - a) Squat
 - b) Push-up
 - c) Lunge
 - d) Biceps curl

B. Fill in the Blanks

1. The point around which a lever moves is called the _____.
2. The point where the body's mass is considered to be concentrated is called the centre of _____.
3. A wider base of support generally provides greater _____.
4. In a lever system, the muscular force applied is called the _____.
5. A squat involves coordinated movement of the hips, knees, and _____.

C. Subjective Questions

1. Explain force and explain the difference between internal and external forces.
2. What is a lever? Name and briefly explain the three classes of levers.
3. Explain the importance of centre of gravity and base of support in maintaining stability and balance.
4. Perform or demonstrate a squat and explain the key joints involved, body alignment, centre of gravity, and stability requirements.
5. Observe a biceps curl and describe the fulcrum, effort, and load involved in the movement. Also identify two common technique errors that may affect movement efficiency.

What have you learned?

After completing this session, you will be able to:

1. explain the basic principles of exercise mechanics and force;
2. elaborate on centre of gravity, base of support, and stability;
3. classify the types of levers and resistance used in exercise;
4. demonstrate proper mechanical techniques in common exercises; and
5. identify common technique errors and methods to improve movement efficiency.

Session 4: Goal-Oriented Programme Planning

A fitness goal is a specific result that a person wants to achieve through physical activity. Goal setting gives direction to exercise and helps a general fitness trainer design an effective programme.

Goals may be short-term, such as improving stamina, or long-term, such as achieving better overall fitness. The programme should be planned according to these goals. This session covers the key principles of fitness goal setting to help trainers understand how to establish clear goals and design exercise programmes that effectively support clients' desired outcomes.

1. Assessing the Starting Point

Before designing a programme, a trainer should understand the client's current fitness level, previous exercise experience, strengths, limitations, available resources, time, schedule, and relevant health and safety considerations. This information helps the trainer create a safe and realistic programme.

2. SMART Fitness Goals

SMART goals help make fitness targets clear and achievable. To ensure these fitness targets are well structured and practical, the SMART framework breaks them down into five key elements, which are as follows:

- (i) **Specific:** The goal should clearly state what the person wants to achieve.
- (ii) **Measurable:** Progress should be possible to track.
- (iii) **Achievable:** The goal should be realistic according to the person's ability.
- (iv) **Relevant:** The goal should match the person's needs and interests.
- (v) **Time-Bound:** A suitable timeframe should be established.

3. Matching Training to Goals

Training should be selected and adjusted according to the client's specific goals, ensuring that exercise type, intensity, volume, and progression are appropriate for achieving the desired outcomes, which are as follows (Fig. 4.3):

- (i) **Strength Goal:** Resistance training with appropriate loads, repetitions, and progressive overload can help develop strength.
- (ii) **Endurance Goal:** Aerobic activities such as walking, running, cycling, or swimming can improve endurance. Duration and intensity should increase gradually.
- (iii) **Flexibility/Mobility Goal:** Appropriate mobility and flexibility exercises should be performed regularly and consistently.
- (iv) **General Fitness Goal:** A combination of strength, endurance, mobility, flexibility, and adequate recovery can be included.



Fig. 4.3: Mechanical analysis of common exercise

4. Programme Variables

Trainers adjust frequency, intensity, time, type, sets, repetitions, resistance, rest intervals, and exercise order according to the individual's goals and fitness level.

5. Programme Progression

Trainers should establish a suitable baseline before gradually increasing training demands. Progression may include greater resistance, exercise complexity, duration, intensity, or volume. Changes should reflect the client's fitness level, recovery ability, and adaptation. Regular monitoring ensures progression remains safe, effective, and appropriate to individual needs.

6. Monitoring and Evaluating Progress

Progress can be evaluated through fitness reassessments, training records, performance indicators, and the client's feedback about effort and recovery. The programme should be adjusted when results show that changes are needed.

7. Individualisation of Programmes

An effective programme considers the client's age, experience, fitness level, goals, preferences, schedule, available equipment, and recovery needs. Individualisation makes exercise more practical, safe, and motivating.

8. Safety and Programme Modification

Trainers should recognise excessive fatigue and modify exercises or training loads when necessary. Progression should be gradual. If a concern is outside the trainer's professional scope, the client should be referred to an appropriate healthcare professional.

9. Ethical Programme Design

Ethical programme design prioritises client safety, informed consent, respect, confidentiality, and evidence-based practice. Trainers should set realistic goals, protect personal information, maintain professional boundaries, and work within their expertise. Exercise plans must reflect individual needs and abilities while avoiding unsafe methods. This approach supports trust, sustainable progress, and long-term client wellbeing.

Practical Exercise

Activity 1: SMART fitness goal setting

Material Required:

1. SMART goal worksheets
2. Client scenario cards
3. Chart paper
4. Markers
5. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a client scenario with a specific fitness need.
- Discuss the client's current fitness level, interests, available time, and limitations.
- Develop one fitness goal using the SMART principle.
- Identify how the goal is Specific, Measurable, Achievable, Relevant, and Time-Bound.
- Write the goal on the worksheet or chart paper.
- Present the goal to the class.
- Discuss whether the goal is realistic and how it can be monitored.

Activity 2: Match training with fitness goals

Material Required:

1. Fitness goal cards
2. Exercise cards
3. Chart paper
4. Markers
5. Stopwatch
6. Notebook and pen

Procedure:

- Divide the class into small groups.
- Give each group different fitness goals such as strength, endurance, flexibility, mobility, or general fitness.

- Select suitable exercises for the assigned goal.
- Decide the appropriate frequency, intensity, time, type, sets, repetitions, and rest periods.
- Arrange the exercises in a logical order.
- Prepare a short training plan based on the selected goal.
- Present the plan to the class.
- Explain why the selected exercises and training variables are suitable for the goal.

Activity 3: Design and evaluate a fitness programme

Material Required:

1. Client profile cards
2. Programme-design worksheets
3. Chart paper
4. Markers
5. Exercise cards
6. Stopwatch
7. Notebook and pen

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a different client profile.
- Identify the client's goal, fitness level, experience, schedule, preferences, and limitations.
- Design a basic weekly exercise programme according to the client's needs.
- Include suitable warm-up, main exercises, cool-down, and recovery.
- Plan gradual progression by adjusting resistance, repetitions, duration, or intensity.
- Identify suitable methods for monitoring progress.
- Present the programme to the class.
- Other groups review the programme and suggest safe modifications.
- Discuss the importance of individualisation, safety, confidentiality, and realistic goal setting.

Check Your Progress

A. Multiple Choice Questions

1. What is a fitness goal?
 - a) A type of exercise equipment
 - b) A specific result a person wants to achieve through physical activity
 - c) A method of measuring body composition
 - d) A recovery technique

2. Which part of a SMART goal means that progress can be tracked?
 - a) Specific
 - b) Measurable
 - c) Relevant
 - d) Time-Bound
3. Which type of training is most suitable for developing muscular strength?
 - a) Resistance training
 - b) Flexibility training
 - c) Relaxation training
 - d) Balance training
4. Which of the following is a programme variable that trainers can adjust?
 - a) Eye colour
 - b) Height
 - c) Rest intervals
 - d) Blood group
5. Which principle ensures that an exercise programme is adapted to the individual client?
 - a) Individualisation
 - b) Standardisation
 - c) Competition
 - d) Repetition

B. Fill in the Blanks

1. SMART stands for Specific, Measurable, Achievable, Relevant, and _____.
2. Before designing a programme, a trainer should assess the client's current _____ level.
3. Walking, running, cycling, and swimming are examples of activities that can improve _____ endurance.
4. Regular monitoring helps trainers evaluate the client's _____.
5. Ethical programme design prioritises client safety, informed consent, respect, and _____.

C. Subjective Questions

1. What are SMART fitness goals? Explain the five components of SMART.
2. Explain how a trainer should assess a client's starting point before designing an exercise programme.
3. Describe the importance of individualisation and progression in fitness programme design.
4. A client wants to improve muscular strength. Design a basic training programme by selecting suitable exercises and stating appropriate programme variables such as sets, repetitions, resistance, and rest.

5. A client has been following an exercise programme for several weeks and has shown improvement in performance. Explain how you would monitor the client's progress and modify the programme safely.

What have you learned?

After completing this session, you will be able to:

- explain the importance of fitness goals and programme planning;
- elaborate on SMART fitness goals and programme variables;
- classify training methods according to different fitness goals;
- demonstrate safe and effective programme progression; and
- identify factors for individualised and ethical programme design.

Unit 5 Special Populations, Technology, and Career Preparation

Unit 5 on ***Special Populations, Technology, and Career Preparation*** covers four sessions covering special population training, exercise precautions, fitness technology, and career readiness. The sessions develop knowledge of inclusive exercise, safety practices, digital fitness tools, professional skills, career opportunities, ethical behaviour, and entrepreneurship for successful fitness careers.

[1] ***Special Population Training Awareness*** introduces special populations and the principles of safe, inclusive, and individualised exercise programming. It deals with exercise modifications, communication, safety, and the fitness professional's role.

[2] ***Exercise Precautions*** explains essential exercise precautions, including pre-exercise screening, risk identification, intensity monitoring, warm-up and cool-down, environmental safety, and appropriate emergency response.

[3] ***Fitness Technology*** deals with fitness technology, including wearable devices, fitness apps, heart-rate monitoring, AI, digital assessment, data privacy, and emerging technologies that support personalised exercise.

[4] ***Career Readiness and Professional Development*** covers career opportunities in fitness and sports, focusing on education, employability skills, resume preparation, job applications, interviews, ethics, professional development, and entrepreneurship.

Session 1: Special Population Training Awareness

Special populations are individuals who may require modified physical activity or exercise programmes due to age, health status, disability, pregnancy, or fitness level. Inclusive physical activity promotes health, independence, confidence, and

participation for everyone. Special populations include children and adolescents, older adults, pregnant and postpartum women, individuals with physical or intellectual disabilities, people living with chronic health conditions, and individuals with obesity or low fitness levels. Each group may have specific safety considerations and exercise requirements. This session covers the key principles of exercise for special populations to help trainers understand their specific needs, safety considerations, and appropriate programme modifications for inclusive and effective participation.

1. Individualised Exercise Programming for Special Populations

Fitness professionals must understand physical and functional limitations, psychological and emotional factors, and individual differences. Exercise needs should be determined through appropriate assessment before participation. Programmes should consider the individual's abilities, goals, medical considerations, experience, and readiness for exercise. Individualised exercise programming for special populations is as follows:

- (i) Senior adults experience age-related changes in strength, balance, mobility, and cardiovascular fitness. Exercise helps maintain independence, confidence, and quality of life. Training should emphasise strength, bone health, balance, joint protection, cardiovascular monitoring, longer warm-up/cool-down, medical conditions, gradual progression, and functional movements. Safety and individual ability should always guide exercise selection.
- (ii) Children and adolescent clients may experience continuous physical, psychological, and hormonal development. Regular exercise supports healthy growth, improves strength, coordination, cardiovascular fitness, concentration, and emotional well-being. Training should emphasise fundamental movement skills, gradual resistance training, moderate intensity, variety, proper technique, mobility, adequate rest, hydration, positive encouragement, and close supervision. Safety, enjoyment, and individual development should always guide exercise selection.
- (iii) Overweight and obese clients may experience reduced movement efficiency, lower exercise tolerance, and increased stress on weight-bearing joints. Regular exercise can improve fitness, mobility, strength, and overall health when introduced safely. Training should emphasise pre-exercise assessment, low-impact aerobics activities, moderate intensity, strength training, functional movements, core stability, realistic goals, gradual progression, and monitoring of fatigue or discomfort. Joint protection and individual ability should always guide exercise selection.

2. Principles of Inclusive Training

Inclusive training should be based on individualisation, appropriate progression, and exercise modification. Intensity and volume must be suitable for the

participant's abilities and condition. Training environments should be accessible, safe, and welcoming. Respecting dignity, privacy, and confidentiality is essential when working with all special populations.

3. Communication and Behavioural Considerations

Effective communication helps establish trust, motivation, and cooperation. Fitness professionals should use respectful and appropriate language, avoid stereotypes and discrimination, and recognise individual preferences and concerns. Maintaining professional boundaries is important for creating a safe and supportive training environment.

4. Role of the Fitness Professional

Fitness professionals must provide safe, individualised exercise within their scope. They should adjust intensity, volume, exercises, range of motion, and rest based on the client's ability and response. Trainers must monitor warning signs like chest pain, dizziness, fainting, severe breathlessness, or abnormal heart rate and stop exercise when needed (Fig. 5.1).



Fig. 5.1: Role of General fitness trianer

Medical conditions, injuries, surgeries, or symptoms beyond their expertise require medical clearance or referral. Accurate documentation and clear communication help to ensure client safety and responsibility. The key responsibilities include:

- a) **Individualise Training:** Adapt exercise intensity, volume, exercise selection, range of motion, and rest according to the client's ability and response.
- b) **Monitor Warning Signs:** Watch for chest pain, severe breathlessness, dizziness, fainting, sharp pain, abnormal heart rate, and other concerning symptoms. Stop exercise when necessary.
- c) **Use Appropriate Monitoring:** Monitor the client's heart rate, breathing, fatigue, and exercise response to ensure safe participation.
- d) **Know Your Scope:** Recognise medical conditions, recent injuries or surgery, uncontrolled health problems, and symptoms beyond your expertise. Seek medical clearance or make an appropriate referral when required.
- e) **Document and Communicate:** Record relevant changes, concerns, and referrals, and maintain clear and professional communication.
- f) **Work Collaboratively:** Coordinate with healthcare professionals, parents, caregivers, and teachers when necessary to support safe and effective practice.

Practical Exercise

Activity 1: Design an exercise programme

Material required:

1. Exercise cards
2. Chart paper
3. Markers

Procedure:

- Divide the class into groups of 4–5 students.
- Assign each group one special population, such as senior adults, children/adolescents, or overweight clients.
- Ask each group to prepare a simple exercise programme with warm-up, main exercises, and cool-down.
- Students should include suitable intensity, duration, rest periods, and safety precautions.
- Each group presents its programme to the class.

Activity 2: Exercise modification challenge

Material required:

1. Exercise cards
2. Chart paper
3. Markers

Procedure:

- Divide students into small groups.
- Give each group a common exercise such as squats, running, jumping jacks, or push-ups.
- Assign a special population to each group.
- Students discuss how the exercise can be modified to make it safe and suitable.
- Each group demonstrates the original and modified exercise.
- Discuss why the modification is required.

Activity 3: Role Play – fitness professional and client**Material required:**

1. Role-play cards

Procedure:

- Divide the class into groups of 3–4 students.
- Assign roles such as fitness professional, client, and observer.
- Give each group a situation involving a special population.
- The fitness professional asks about the client's abilities, goals, health concerns, and exercise experience.
- The professional suggests suitable exercises and safety measures.
- The observer gives feedback on communication, respect, individualisation, and safety.

Check Your Progress

A. Multiple Choice Questions

1. Which of the following is an important exercise consideration for senior adults?
 - a) Maximum-intensity training
 - b) Balance and joint protection
 - c) Avoiding all resistance training
 - d) Eliminating warm-up and cool-down
2. Exercise for children and adolescents should primarily emphasise:
 - a) Heavy resistance training
 - b) Fundamental movement skills
 - c) Maximum exercise intensity
 - d) Long-duration endurance training
3. Which type of aerobic activity is generally emphasised for overweight and obese clients?
 - a) High-impact activities
 - b) Low-impact activities

- c) Maximal sprinting
 - d) Competitive lifting
4. Which of the following is a warning sign that may require stopping exercise?
 - a) Mild sweating
 - b) Improved coordination
 - c) Chest pain
 - d) Increased motivation
 5. Fitness professionals should work within their:
 - a) Personal preferences
 - b) Scope of practice
 - c) Client's occupation
 - d) Competition level

B. Fill in the Blanks

1. Special populations may require _____ physical activity or exercise programmes.
2. Exercise programmes for senior adults should emphasise strength, balance, mobility, and _____ health.
3. Children and adolescents should receive adequate rest and _____ during exercise.
4. Respecting dignity, privacy, and _____ is essential in inclusive training.
5. Accurate _____ helps ensure client safety and responsible practice.

C. Subjective Questions

1. State any four principles of inclusive training.
2. Describe the role of a fitness professional when working with special populations.
3. A senior adult client has reduced balance and mobility. List four exercise-programming considerations that a fitness professional should follow for this client.
4. An overweight client experiences low exercise tolerance and discomfort in weight-bearing joints. Suggest four appropriate training considerations for designing a safe exercise programme.

What have you learned?

After completing this session, you will be able to:

- explain the importance of individualised exercise programming for special populations;
- elaborate on the principles of inclusive and safe training;
- classify special populations according to their exercise needs;
- demonstrate appropriate exercise modifications for special populations; and
- identify safety considerations and the role of fitness professionals.

Session 2: Exercise Precautions

Exercise precautions are measures taken to reduce the risk of injury, illness, or other complications during physical activity. Safety is essential for effective participation and injury prevention. Fitness professionals should identify potential risks and create an exercise environment that supports safe and appropriate participation. This session covers key exercise precautions to help trainers identify potential risks, promote injury prevention, and create a safe, supportive, and appropriate exercise environment for all clients.

Pre-Exercise Screening helps identify relevant health conditions, risk factors, previous injuries, and current fitness levels before exercise begins. Basic health and fitness information should be collected to determine whether modifications or further assessment are needed. Medical clearance may be appropriate for individuals with certain health concerns or risk factors (Fig. 5.2).

CARDIOVASCULAR & RESPIRATORY	METABOLIC CONDITIONS	MUSCULOSKELETAL LIMITATIONS
 Poor technique Increases risk of injury and strain.	 Energy & recovery Inadequate nutrition or rest impairs performance.	 Pain & mobility Pain can limit movement and affect performance.
 Excessive training load Can lead to overtraining, fatigue and burnout.	 Medication/medical conditions Certain conditions or medications may affect exercise safety.	 Weakness & instability Muscle imbalances increase the risk of injury.
 Unsuitable equipment Improper or poorly maintained equipment increases risk.	 Monitor blood glucose Important for individuals with diabetes or at risk.	 Swelling May indicate injury or overuse.
 Supervise • Progress Gradually Ensure safe technique and increase intensity step by step.	 MONITOR • ADJUST • SUPERVISE	 Excessive Fatigue Can reduce performance and increase injury risk.
SUPERVISE • PROGRESS GRADUALLY		LISTEN • MODIFY • RECOVER

Fig. 5.2: Exercise related risks

1. Common Exercise-Related Risks

Common risks include musculoskeletal injuries, dehydration, heat-related problems, excessive fatigue, dizziness, and fainting. According to the necessity, exercise-related risks are as follows:

- (i) **Cardiovascular and respiratory considerations:** Poor exercise technique, unsuitable equipment, or inappropriate training loads can also increase injury risk. Proper instruction, supervision, and gradual progression help minimise these risks.
- (ii) **Metabolic condition considerations:** Metabolic conditions can affect energy, exercise tolerance, and recovery. Trainers should consider medical conditions, medications, and fitness levels. Monitor blood glucose and warning signs, adjust intensity, provide supervision, and progress gradually for safe exercise.
- (iii) **Musculoskeletal limitations:** Musculoskeletal limitations affect movement, stability, and exercise tolerance. Trainers should assess pain, mobility,

strength, and movement quality. Use pain-free exercises, gradual progression, suitable modifications, and monitor for swelling, instability, or worsening pain.

2. Exercise Intensity and Monitoring

Exercise intensity should be appropriate to the individual's fitness, goals, and condition. Intensity can be monitored through heart-rate awareness, rating of perceived exertion (RPE), and the talk test. Participants should be encouraged to recognise unusual breathlessness, excessive fatigue, dizziness, pain, or other signs of overexertion.

3. Warm-Up and Cool-Down

A warm-up prepares the body for exercise by gradually increasing movement, circulation, and muscle activity. An effective warm-up should reflect the planned activity. A cool-down allows the body to gradually return toward its resting state and may include gentle movement and appropriate stretching to support recovery.

4. Environmental and Equipment Safety

Hot and humid conditions require additional attention to hydration, rest, clothing, and exercise intensity. Appropriate footwear and clothing should be used. Equipment must be inspected regularly and used correctly. Exercise areas should remain clean, organised, accessible, and free from avoidable hazards.

5. Warning Signs and Emergency Response

Exercise should be stopped when serious symptoms such as chest pain, severe breathlessness, fainting, confusion, or significant pain occur. Fitness professionals should know emergency procedures and how to seek appropriate medical assistance. Basic awareness of first aid and CPR is an important part of exercise safety.

Practical Exercise

Activity 1: Exercise risk identification

Material required:

1. Flash cards
2. Chart paper
3. Markers

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group cards showing different exercise-related risks such as dehydration, dizziness, muscle injury, excessive fatigue, and heat exhaustion.
- Students identify the risk shown on each card.

- Groups discuss the possible causes and precautions for each risk.
- Each group presents its answers to the class.

Activity 2: Exercise safety checklist

Material required:

1. Chart paper
2. Markers
3. Pictures of exercise equipment.

Procedure:

- Divide students into small groups.
- Ask each group to prepare a safety checklist for an exercise session.
- Students include pre-exercise screening, warm-up, correct equipment, hydration, suitable intensity, and cool-down.
- Groups identify possible hazards in an exercise area.
- Each group presents its checklist and explains how the precautions reduce risk.

Activity 3: Warning signs role-play

Material required: Role-play cards.

Procedure:

- Divide the class into groups of 3–4 students.
- Give each group a situation involving a warning sign such as chest pain, dizziness, fainting, severe breathlessness, or significant pain.
- Assign roles such as fitness professional, participant, and observer.
- Students act out the situation and demonstrate the appropriate response.
- The observer checks whether the exercise was stopped and appropriate medical assistance was sought.
- Discuss the importance of recognising warning signs and responding quickly.

Check Your Progress

A. Multiple Choice Questions

1. What is the main purpose of pre-exercise screening?
 - a) To increase exercise intensity
 - b) To identify health conditions and risk factors
 - c) To eliminate the need for supervision
 - d) To determine competition level
2. Which of the following is a common exercise-related risk?
 - a) Dehydration
 - b) Improved flexibility

- c) Increased confidence
 - d) Better coordination
3. Which method can be used to monitor exercise intensity?
- a) Talk test
 - b) Body height
 - c) Shoe size
 - d) Body posture
4. What is the main purpose of a warm-up?
- a) To gradually prepare the body for exercise
 - b) To cause muscle fatigue
 - c) To reduce circulation
 - d) To replace the exercise session
5. Which symptom is a warning sign requiring exercise to be stopped?
- a) Mild sweating
 - b) Improved breathing
 - c) Chest pain
 - d) Normal muscle movement

B. Fill in the Blanks

1. Pre-exercise screening helps identify relevant health conditions, risk factors, previous injuries, and current _____ levels.
2. Trainers should monitor blood _____ in individuals with metabolic conditions.
3. Exercise intensity can be monitored using heart rate, RPE, and the _____ test.
4. A _____ prepares the body for exercise by gradually increasing movement and circulation.
5. Basic awareness of first aid and _____ is an important part of exercise safety.

C. Subjective Questions

1. Explain the importance of pre-exercise screening.
2. Describe any four common exercise-related risks.
3. A client becomes dizzy and experiences severe breathlessness during exercise. What precautions and immediate actions should a fitness professional take?
4. A client is exercising in hot and humid conditions. List four measures that can be taken to ensure safe participation.

What have you learned?

After completing this session, you will be able to:

- explain the importance of pre-exercise screening and exercise precautions;

- elaborate on common exercise-related risks and their prevention;
- classify exercise risks based on cardiovascular, metabolic, and musculoskeletal conditions;
- demonstrate safe warm-up, cool-down, and exercise-intensity monitoring techniques; and
- identify warning signs, environmental hazards, and appropriate emergency responses.

Session 3: Fitness Technology

Fitness technology refers to digital tools and devices used to monitor, assess, plan, and improve physical activity and exercise. Technology has evolved from basic activity counters to advanced wearable and online systems. It can support performance tracking, motivation, goal setting, and informed exercise planning. This session covers key aspects of fitness technology to help trainers understand how digital tools and Artificial Intelligence (AI) can support activity monitoring, performance tracking, motivation, goal setting, and effective exercise planning.

1. Types of Fitness Technology

Common fitness technologies include fitness trackers, smartwatches, heart-rate monitors, pedometers, mobile fitness applications, smart gym equipment, and online fitness platforms. These tools provide different functions, ranging from basic activity tracking to detailed exercise monitoring and digital coaching.

2. Monitoring Fitness and Physical Activity

Technology can monitor steps, heart rate, activity duration, exercise intensity, estimated calories or energy expenditure, sleep, and recovery. Basic fitness-performance data can help individuals understand their activity patterns and monitor changes over time. However, users should recognise that some measurements are estimates rather than exact values.

3. Using Technology for Exercise Planning

Digital tools can help users establish fitness goals, record workouts, track progress, and follow structured exercise programmes. Collected information may help fitness professionals and individuals adjust exercise frequency, intensity, duration, and activities according to progress and personal goals.

4. Technology and Fitness Assessment

Digital measurement tools can simplify the collection, storage, and comparison of fitness data. They may improve convenience and provide regular feedback. However, technology-based assessments have limitations. Device accuracy and reliability can vary depending on the device, activity, user, and measurement method.

5. Fitness Technology in Training

Fitness technology helps trainers organise workouts, monitor performance, track progress, and improve motivation. For example, fitness watches can record steps, calories, and workout duration, while training apps can track exercise history (Fig. 5.3).



Fig. 5.3: Fitness technology for monitoring performance

Some of the commonly used technological devices are as follows:

- (i) **Wearables and Heart Rate Monitoring:** Wearable devices such as fitness bands and smartwatches can monitor heart rate, distance, steps, and calories. For example, a trainer may use heart-rate data to check whether a client is exercising at an appropriate intensity.
- (ii) **Real-Time Heart Rate Monitoring:** Real-time heart-rate monitoring allows trainers to adjust exercise intensity immediately. For example, if a client's heart rate becomes too high during cycling, the trainer can reduce the resistance or workload.
- (iii) **Target Heart Rate Zone Regulation:** Heart-rate zones help trainers plan aerobic and interval workouts according to fitness goals. For example, a client improving cardiovascular fitness may exercise within a moderate target heart-rate zone.
- (iv) **Recovery Monitoring and Adaptation:** Recovery data can help trainers identify fatigue and modify future sessions. For example, if a wearable shows poor recovery after intense training, the next workout may focus on lighter exercise or recovery activities.
- (v) **Device Types and Accuracy:** Different devices provide different levels of accuracy. For example, chest-strap heart-rate monitors are generally more accurate than wrist-based monitors during vigorous exercise.

6. Digital Health and Awareness

Fitness technology collects personal health and activity information, making privacy and data security important considerations. Users should understand application permissions and use reputable platforms. Online fitness information should be evaluated carefully, as misinformation can be misleading or unsafe. Technology can support safer exercise for clients who need controlled intensity. However, wearable data may not always be accurate. Trainers should combine technology with observation, client feedback, and professional judgement.

7. Fitness Apps and Communication

Apps can record workouts, attendance, progress, lifestyle information, and schedules. For example, trainers may use an app to send workout plans, record completed exercises, and communicate with clients.

8. Ethics and Data Privacy

General fitness trainers must obtain client consent and protect personal information. For example, health and fitness records should be stored securely and shared only when appropriate.

9. Artificial Intelligence in Fitness

Artificial Intelligence (AI) is increasingly used for personalised workout planning, performance analysis, and motivation (Fig. 5.4). For example, an AI fitness app may suggest exercises based on a person's goals, fitness level, and previous workouts. AI can also act as a virtual coach by providing reminders and general exercise guidance. Some of the uses of AI are as follows:

- (i) **Personalised workout planning:** AI creates workouts based on a person's goals, fitness level, and past activities. For example, an app suggests a beginner running plan for someone who wants to lose weight.
- (ii) **Performance analysis:** AI studies fitness data to find patterns and track progress. For example, a smartwatch analyses your running speed and tells you that your pace has improved.
- (iii) **Personalised recommendations:** AI suggests exercises or changes according to the user's data. For example, if you have been doing too much cardio, an app may suggest adding strength training.
- (iv) **Motivation and reminders:** AI send reminders, feedback, and encouragement. For example, an app reminds you to complete your daily workout.
- (v) **Virtual coaching:** AI can provide basic exercise guidance and answer fitness questions. For example, a fitness chatbot explains how to perform a squat correctly.



Fig. 5.4: Applications of artificial intelligence in fitness training and personalised exercise planning

However, AI recommendations may not always be accurate or suitable for every person. Trainers should review AI-generated information and use professional judgement. AI should support, rather than replace, qualified fitness and healthcare professionals.

10. Emerging Trends in Fitness Technology

Emerging developments include artificial intelligence, virtual and augmented reality, wearable health technology, online coaching, virtual training, and technology-assisted rehabilitation. These innovations may provide increasingly personalised, accessible, and interactive approaches to exercise and fitness management.

Practical Exercise

Activity 1: Fitness technology demonstration

Material required:

1. Smartphone
2. Smartwatch/fitness band
3. Pedometer
4. Fitness app

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a fitness technology device or app.

- Identify the information it can measure, such as steps, heart rate, distance, calories, or exercise duration.
- Record the data during a short physical activity.
- Each group presents the device, its uses, and its limitations to the class.

Activity 2: Fitness app exercise planning

Material required:

1. Smartphones/tablets
2. Fitness app
3. Chart paper
4. Markers

Procedure:

- Divide students into small groups.
- Give each group a fitness goal, such as improving cardiovascular fitness, increasing strength, or improving general fitness.
- Use fitness app or its sample features to create a simple weekly exercise plan.
- The plan should include type, frequency, duration, intensity, and rest.
- Groups present their plans and explain how technology helps in monitoring progress.

Activity 3: AI Fitness Coach Role Play

Material required:

1. Smartphones/tablets
2. Chart paper
3. Markers
4. Role card

Procedure:

- Divide students into groups of 3–4.
- Assign roles such as AI fitness coach, client, and fitness professional.
- Give the client a fitness goal and basic information about their fitness level.
- The AI coach suggests a simple workout or fitness recommendation.
- The fitness professional reviews the recommendation and identifies whether any changes are needed.
- Discuss why AI should support, but not replace, qualified fitness professionals and why personal data should be kept private.

Check Your Progress

A. Multiple Choice Questions

1. Which device is commonly used to monitor heart rate during exercise?
 - a) Pedometer
 - b) Heart-rate monitor

- c) Stopwatch
 - d) Measuring tape
2. Which fitness technology can track steps, heart rate, and workout duration?
 - a) Smartwatch
 - b) Exercise mat
 - c) Resistance band
 - d) Medicine ball
 3. What can recovery monitoring help trainers identify?
 - a) Fatigue
 - b) Height
 - c) Body structure
 - d) Shoe size
 4. Which device is generally more accurate for heart-rate monitoring during vigorous exercise?
 - a) Wrist-based monitor
 - b) Chest-strap monitor
 - c) Pedometer
 - d) Mobile phone
 5. What is one important consideration when using fitness technology?
 - a) Ignoring client feedback
 - b) Data privacy
 - c) Avoiding all technology
 - d) Increasing exercise intensity automatically

B. Fill in the Blanks

1. Fitness technology includes fitness trackers, smartwatches, heart-rate monitors, and mobile fitness _____.
2. Technology can monitor steps, heart rate, activity duration, and exercise _____.
3. Heart-rate zones can help trainers plan aerobic and _____ workouts.
4. Trainers must obtain client _____ before collecting and using personal information.
5. AI should support, rather than _____, qualified fitness and healthcare professionals.

C. Subjective Questions

1. List any four uses of artificial intelligence in fitness.
2. Explain the importance of ethics and data privacy when using fitness technology.
3. A trainer notices that a client's heart rate becomes too high during cycling. What can the trainer do using real-time heart-rate monitoring?

4. A client's wearable device shows poor recovery after an intense training session. How should the trainer modify the client's next workout?

What have you learned?

After completing this session, you will be able to:

- explain the importance and types of fitness technology in exercise and physical activity;
- elaborate on the use of technology for fitness monitoring, assessment, and exercise planning;
- classify different fitness technologies such as wearables, apps, heart-rate monitors, and smart equipment;
- demonstrate how fitness technology can be used to monitor exercise intensity and track progress; and
- identify the benefits, limitations, ethical issues, and privacy concerns of fitness technology.

Session 4: Career Readiness and Professional Development

The fitness and sports sector offers diverse careers, including general fitness trainers, instructors, strength and conditioning specialists, sports coaches, wellness professionals, and sports administrators. Entrepreneurship also provides opportunities to establish fitness centres, coaching services, or wellness programmes. This session explores career and entrepreneurship opportunities in the fitness and sports sector, helping trainers understand different professional roles, career pathways, and opportunities to establish fitness, coaching, and wellness services.

1. Educational and Professional Pathways

Relevant courses, qualifications, and professional certifications help individuals develop knowledge and practical skills. Higher education in physical education, sports science, fitness, or management can improve career prospects. Individuals seeking advanced education may pursue degrees such as Bachelor of Physical Education (B.P.Ed.), Master of Physical Education (M.P.Ed.), or sports science programmes. Lifelong learning and continuing professional development are essential for staying updated with industry practices.

2. Essential Employability Skills

Successful professionals need effective communication, teamwork, leadership, problem-solving, and time-management skills. Digital literacy, customer service, adaptability, and professional behaviour are equally important for building positive workplace relationships and delivering quality services.

3. Resume/CV Preparation

A CV (Curriculum Vitae)/resume showcases an individual's education, skills, certifications, professional experience, achievements, and extracurricular activities. Participation in sports, coaching experience, volunteering, and fitness-related accomplishments can further enhance a CV. It should be clear, accurate, well-organised, and free from spelling and formatting errors. In summary, the following key points should be considered:

- i) **Structured and Industry-Focused Resume** – A clear resume that shows your education, certificates, skills, and work experience.
- ii) **Evidence-Based Professional Portfolio** – A collection of documents and examples that prove your practical fitness knowledge and experience.
- iii) **Demonstration of Programme Design Competence** – Shows that you can create safe and effective workout plans for different client goals.
- iv) **Digital Professional Profile** – A professional online profile that shows your qualifications, skills, experience, and fitness knowledge.

4. Job Search and Application Skills

Career opportunities can be identified through job-search platforms, professional networks, institutions, and company websites. Applicants should understand job descriptions, prepare suitable applications, communicate professionally through email, and maintain a professional digital profile.

5. Interview Preparation

Interview preparation includes practising common questions, preparing a professional introduction, and demonstrating confidence. Appropriate body language, active listening, clear communication, relevant examples, punctuality, and professional etiquette can create a positive impression.

6. Professional Ethics and Workplace Behaviour

Fitness professionals must demonstrate responsibility, honesty, integrity, respect, and inclusivity. They should maintain client confidentiality, observe professional boundaries, follow workplace safety procedures, and use technology responsibly.

7. Personal Branding and Professional Development

Understanding personal strengths and areas for improvement supports career growth. Setting realistic goals, networking, developing an online professional presence, and creating a personal development plan help individuals progress professionally.

8. Entrepreneurship and Career Opportunities

Fitness entrepreneurship involves identifying client needs and developing suitable services. A basic business plan should consider services, target clients, pricing, marketing, and promotion. Customer satisfaction, quality service, professionalism, and continuous improvement are essential for building a successful fitness or wellness business.

Practical Exercise

Activity 1: Discover fitness and sports careers

Material Required:

1. Career cards
2. Chart paper
3. Markers
4. Textbooks or reference materials

Procedure:

- Divide the class into groups of 4–5 students.
- Give each group a different fitness or sports career, such as general fitness trainer, sports coach, yoga instructor, or sports administrator.
- Find information about the qualifications, skills, duties, and career opportunities related to the career.
- Prepare a short presentation on chart paper.
- Each group presents its career to the class.

Activity 2: Prepare a fitness career CV

Material Required:

1. Sample CV/resume
2. A4 sheets
3. Pens/pencils
4. Chart paper
5. Markers

Procedure:

- Divide students into small groups.
- Provide a sample profile of a student interested in a fitness or sports career.
- Prepare a simple CV including education, skills, certifications, sports achievements, experience, and extracurricular activities.
- Check the CV for proper format, spelling, and organisation.
- Each group presents its CV and explains the important sections.

Activity 3: Mock interview for a fitness job

Material Required:

1. Interview question cards
2. Role cards
3. Chairs and a table
4. Pen and paper
5. Sample CVs

Procedure:

- Divide the class into groups of 3–4 students.
- Assign the roles of interviewer, job applicant, and observer.
- Give the applicant a sample CV and the interviewer a set of questions.
- Conduct a mock interview for a fitness or sports-related job.
- The applicant answers questions about qualifications, skills, experience, strengths, and career goals.
- The observer evaluates communication, confidence, body language, and professional behaviour.
- Discuss the strengths and areas for improvement after the interview.

Check Your Progress

A. Multiple Choice Questions

1. Which of the following is a career opportunity in the fitness and sports sector?
 - a) General Fitness trainer
 - b) Accountant
 - c) Architect
 - d) Pharmacist
2. Which qualification is related to physical education?
 - a) B.P.Ed.
 - b) B.Com.
 - c) B.Arch.
 - d) B.Sc. Chemistry
3. Which skill is essential for successful fitness professionals?
 - a) Communication
 - b) Ignoring clients
 - c) Avoiding teamwork
 - d) Poor time management
4. Which of the following should be included in a CV/resume?
 - a) Education and certifications
 - b) Personal opinions about clients

- c) Unverified information
 - d) Irrelevant advertisements
5. Which factor is important for a successful fitness business?
- a) Customer satisfaction
 - b) Ignoring client needs
 - c) Avoiding promotion
 - d) Reducing service quality

B. Fill in the Blanks

1. Lifelong learning and continuing professional _____ are essential for career development.
2. A CV/resume showcases an individual's education, skills, certifications, and professional _____.
3. Interview preparation includes practising common questions and demonstrating _____.
4. Fitness professionals must maintain client _____ and professional boundaries.
5. A basic business plan should consider services, target clients, pricing, marketing, and _____.

C. Subjective Questions

1. State any four essential employability skills required in the fitness and sports sector.
2. List any four important points that should be considered while preparing a CV/resume.
3. State any four aspects of professional ethics and workplace behaviour.
4. You are applying for a general fitness trainer position. Describe four steps you would take to prepare for the job interview.
5. You want to start a small fitness or wellness business. List four important factors you would consider while preparing a basic business plan.

What have you learned?

After completing this session, you will be able to:

- explain the career opportunities and professional pathways in the fitness and sports sector;
- elaborate on the essential employability skills required for fitness professionals;
- classify different career opportunities and entrepreneurship options in the fitness industry;
- demonstrate effective resume preparation, job application, and interview skills; and
- identify the importance of professional ethics, personal branding, and continuous career development.

Answer Key

Unit 1: Diet and Nutrition for Fitness Trainers

Session 1: Nutrition Foundations

A. Multiple Choice Questions

1. b
2. c
3. a
4. c
5. c

B. Fill in the Blanks

1. Nutrition
2. Macronutrients
3. Glycogen
4. Water
5. Individualised

Session 2: Nutrition Timing Around Exercise

A. Multiple Choice Questions

1. b
2. b
3. b
4. a
5. c

B. Fill in the Blanks

1. Fluid
2. Digestive
3. Carbohydrates
4. Repair
5. Hydration

Session 3: Hydration and Digestion Awareness

A. Multiple Choice Questions

1. b
2. a
3. c
4. c
5. a

B. Fill in the Blanks

1. Fluid
2. Sweating
3. Potassium

4. Small
5. Water

Session 4: Supplements, Myths, and Professional Limits

A. Multiple Choice Questions

1. b
2. a
3. c
4. a
5. c

B. Fill in the Blanks

1. Supplement
2. Protein
3. Evidence
4. Allergy
5. Scope

Unit 2: Applied Kinesiology and Physiology

Session 1: Anatomical Foundations of Movement

A. Multiple Choice Questions

1. b
2. c
3. c
4. b
5. c

B. Fill in the Blanks

1. Kinesiology
2. Forward
3. Sagittal
4. Side-to-side
5. Vertical

Session 2: Muscles and Movement Basics

A. Multiple Choice Questions

1. c
2. a
3. a
4. b
5. b

B. Fill in the Blanks

1. Tendons
2. Sarcomeres
3. Slow

4. Powerful
5. Stabilisers

Session 3: Energy Systems and Exercise Response

A. Multiple Choice Questions

1. b
2. c
3. c
4. c
5. a

B. Fill in the Blanks

1. Triphosphate
2. ATP-PC
3. Glucose
4. Oxygen
5. Together

Session 4: Cardiorespiratory Response

A. Multiple Choice Questions

1. b
2. c
3. b
4. c
5. a

B. Fill in the Blanks

1. Four
2. Atria
3. Systemic
4. Alveoli
5. Heart rate

Unit 3: Health Screening and Fitness Assessment

Session 1: Exercise Readiness

A. Multiple Choice Questions

1. b
2. b
3. c
4. b
5. c

B. Fill in the Blanks

1. Lifestyle
2. Information
3. Exercise
4. Psychological
5. Breathlessness

Session 2: Fitness Assessment Components

A. Multiple Choice Questions

1. b
2. c
3. d
4. a
5. b

B. Fill in the Blanks

1. Baseline
2. Validity
3. Reliability
4. Fatigue
5. Motivation

Session 3: Readiness Questionnaires

A. Multiple Choice Questions

1. a
2. a
3. b
4. c
5. c

B. Fill in the Blanks

1. Questionnaire
2. Screening
3. Risk
4. Modify
5. Warm-Up

Session 4: Body Composition Awareness

A. Multiple Choice Questions

1. a
2. c
3. b
4. c
5. c

B. Fill in the Blanks

1. Components
2. Essential
3. BMI
4. Electrical
5. Confidential

UNIT 4: Exercise Science and Programme Design

Session 1: Structure of an Exercise Programme

A. Multiple Choice Questions

1. b
2. c
3. b
4. c
5. b

B. Fill in the Blanks

1. Cool-Down
2. Intensity
3. Time
4. Multiple
5. Recovery

Session 2: Strength and Endurance Principles

A. Multiple Choice Questions

1. b
2. c
3. b
4. a
5. c

B. Fill in the Blanks

1. Endurance
2. Overload
3. Continuous
4. Exercises
5. Recover

Session 3: Exercise Mechanics

A. Multiple Choice Questions

1. b
2. c
3. b
4. c
5. d

B. Fill in the Blanks

1. Fulcrum
2. Gravity
3. Stability
4. Effort
5. Ankles

Session 4: Goal-Oriented Programme Planning

A. Multiple Choice Questions

1. b
2. b
3. a
4. c
5. a

B. Fill in the Blanks

1. Time-Bound
2. Fitness
3. Cardiorespiratory
4. Progress
5. Confidentiality

Unit 5: Special Populations, Technology, and Career Preparation

Session 1: Special Population Training Awareness

A. Multiple Choice Questions

1. b
2. b
3. b
4. c
5. b

B. Fill in the Blanks

1. Modified
2. Cardiorespiratory
3. Recovery
4. Confidentiality
5. Documentation

Session 2: Exercise Precautions

A. Multiple Choice Questions

1. b
2. a
3. a
4. a
5. c

B. Fill in the Blanks

1. Activity
2. Glucose
3. Talk
4. Warm-Up
5. CPR

Session 3: Fitness Technology

A. Multiple Choice Questions

1. b
2. a
3. a
4. b
5. b

B. Fill in the Blanks

1. Apps
2. Duration
3. Interval
4. Consent
5. Replace

Session 4: Career Readiness and Professional Development

A. Multiple Choice Questions

1. a
2. a
3. a
4. a
5. a

B. Fill in the Blanks

1. Development
2. Experience
3. Confidence
4. Confidentiality
5. Expenses

Glossary

Aerobic System: An energy system that uses oxygen to produce energy during prolonged, generally moderate-intensity activities.

Anaerobic System: An energy system that produces energy without directly using oxygen, particularly during short-duration, high-intensity activities.

Anatomical Position: A standard body position used as a reference for describing the location and movement of body parts, with the body standing upright and the palms facing forward.

Body Composition: The relative proportions of fat mass and fat-free or lean mass in the body.

Body Mass Index (BMI): A screening measure calculated from height and body weight that is used to classify weight status.

Cardiorespiratory Fitness Test: An assessment used to measure aerobic or cardiorespiratory endurance.

Cardiorespiratory Response: The responses of the heart, lungs, and circulatory system to exercise to meet the body's increased demand for oxygen.

Client Screening: The process of identifying potential health risks and exercise-related concerns before a client begins an exercise programme.

Cool-down: A gradual reduction in exercise intensity after physical activity to help the body return toward its resting state.

Electrolytes: Minerals that help regulate fluid balance, nerve function, and muscle contraction.

Endurance: The ability to sustain physical activity for an extended period.

Energy Systems: Physiological systems that produce energy in the form of ATP, including the ATP-PC, glycolytic, and oxidative systems.

Exercise Intensity: The level of effort or difficulty required during physical activity or exercise.

Fatigue: A temporary reduction in the ability to perform physical or mental tasks due to exertion or exhaustion.

Fitness Technology: The use of devices, applications, and digital tools to monitor, assess, and improve fitness and physical activity.

Flexibility: The range of motion available at a joint or group of joints.

Form (Exercise Technique): The manner in which an exercise is performed to promote effectiveness, efficiency, and safety.

Functional Training: Exercise that develops strength, balance, coordination, and movement patterns relevant to daily activities or specific tasks.

Glycogen: The stored form of carbohydrate found mainly in the muscles and liver that can be used as an energy source during exercise.

Goal Setting: The process of establishing specific and measurable objectives to guide fitness training and monitor progress.

Hydration: Maintaining an adequate balance of fluids in the body.

Hypertrophy: An increase in muscle size, primarily resulting from an increase in the size of individual muscle fibres.

Injury Prevention: Practices and strategies used to reduce the risk of injury during physical activity and exercise.

Intensity: The level of effort or difficulty performed during exercise.

Interval Training: A training method that alternates periods of higher-intensity exercise with periods of lower-intensity exercise or recovery.

Kinesiology: The study of human movement and the factors that influence movement.

Load: The amount of weight, resistance, or external force applied during exercise.

Macronutrients: Nutrients required by the body in relatively large amounts, including carbohydrates, proteins, and fats.

Micronutrients: Vitamins and minerals required by the body in relatively small amounts to support normal growth, development, and physiological functions.

Muscle Endurance: The ability of a muscle or muscle group to perform repeated contractions or sustain a contraction over time.

Muscle Strength: The maximum force that a muscle or muscle group can produce.

Neuromuscular Coordination: The coordinated interaction between the nervous system and muscles to produce controlled movement.

Nutrition Timing: The planned timing of food and nutrient intake in relation to exercise to support energy, performance, and recovery.

Overload Principle: The principle of gradually increasing the demands placed on the body to stimulate improvements in fitness.

PAR-Q (Physical Activity Readiness Questionnaire): A screening questionnaire used to identify individuals who may need further medical advice before participating in physical activity.

Performance: The ability to perform physical tasks effectively and efficiently.

Post-exercise Nutrition: Nutritional intake after exercise that supports recovery, replenishment of energy stores, and tissue repair.

Pre-exercise Nutrition: Food and fluid intake before exercise intended to provide energy, support performance, and help prevent fatigue.

Professional Ethics: Principles and standards of professional behaviour that guide fitness trainers in their work.

Progression: The gradual increase in training demands, such as intensity, volume, frequency, or complexity, as fitness improves.

Protein: A macronutrient essential for tissue repair, muscle growth, and many other functions in the body.

Recovery: The process through which the body restores energy, repairs tissues, and adapts following exercise.

Resistance Training: Exercise performed against external resistance to improve muscular strength, endurance, power, or muscle size.

Rest Interval: The period of rest taken between sets, exercises, or training intervals.

Special Population: A group of individuals who may require adapted or modified exercise programmes because of age, health status, physical limitations, or other specific needs.

Specificity Principle: The principle that training adaptations are specific to the type of exercise, muscles, movements, and fitness goals being trained.

Stamina: The ability to sustain physical or mental effort for an extended period.

Supplement: A product used to supplement the diet with nutrients or other dietary ingredients.

Technique: The correct and controlled execution of an exercise or movement to promote safety and effectiveness.

Training Programme: A structured plan of exercises designed to achieve specific fitness goals.

Volume (Training Volume): The total amount of work performed during training, commonly determined by factors such as sets, repetitions, duration, distance, or load.

Warm-up: A preparation phase before exercise involving activities that gradually increase body temperature, blood flow, and readiness for physical activity.

Work Capacity: The amount of physical work a person is capable of performing over a given period.



PSS CENTRAL INSTITUTE OF VOCATIONAL EDUCATION
(A constituent unit of NCERT, under Ministry of Education, Government of India)
Shyamla Hills, Bhopal- 462 002, M.P., India
www.psscive.ac.in