Unit 18: Effects of Exercise on the Body Systems

Unit code: J/600/2832

QCF Level 2: BTEC First

Credit value: 5

Guided learning hours: 30

Aim and purpose

This unit is designed to enable learners to explore the effects of exercise on the human body by participating in a range of practical experiments and activities.

Unit introduction

At some point in their life, most people will have taken part in exercise or physical activity. For many people, exercise is a part of their normal lifestyle which helps to keep them fit and healthy. In the sports industry, many careers require an understanding of how the body responds to exercise. During exercise, the human body undergoes a number of changes, and the aim of this unit is to explore these changes.

Learners will initially cover the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems. Learners will then carry out a practical investigation exploring these short-term effects and 'seeing' for themselves the different responses that occur.

The unit continues by exploring the long-term effects of exercise and how the various body systems adapt to training. The different energy systems are then covered together with the different sports that use each of these systems to supply energy. Learners will also be able to find out which sports 'burn' the most calories by examining the energy requirements of different forms of physical activity.

To complete the unit, the impact of drugs on sport and sports performance will be examined. A range of different types of drugs and their effects on sports performance and the health of the athlete will be covered. Finally, the effect of drugs on society and sport itself is explored.

Learning outcomes

On completion of this unit a learner should:

1 Be able to investigate the short-term effects of exercise on the body systems

2 Know the long-term effects of exercise on the body systems

3 Be able to investigate the fundamentals of the energy systems

4 Know the impact of drugs on sports performance.

Unit content

1 Be able to investigate the short-term effects of exercise on the body systems

Musculoskeletal system: eg increased joint range of movement, micro tears in muscle fibres

Cardiovascular system: eg increased heart rate, increased blood pressure

Respiratory system: eg increase in breathing rate, increased tidal volume

Methods of investigation: participation in practical activities eg football, sprinting, swimming, jogging, cycle ergometer; taking physiological measurements eg heart rate monitor, pulse rate, blood pressure, sit and reach test, spirometer; recording data eg tables, ICT downloads

2 Know the long-term effects of exercise on the body systems

Musculoskeletal system: eg hypertrophy, increase in tendon strength, increase in bone density, increased thickness of hyaline cartilage, increased production of synovial fluid

Cardiorespiratory system: eg decrease in resting heart rate, increase in stroke volume, increase in heart size, increased vital capacity

3 Be able to investigate the fundamentals of the energy systems

Energy systems: anaerobic energy system (alactic acid/phosphocreatine, lactic acid); sports that use these systems to provide energy eg sprinting, 100m, 400m; aerobic energy system (requirement of oxygen); sports that use this system to provide energy eg long distance running

Energy requirements of physical activity: calories used in taking part in different forms of physical activity eg swimming, sprinting, walking

Methods of investigation: participation/observation of alactic acid energy system sports activities eg vertical jump, 50m sprint; participation/observation of lactic acid energy system sports eg 400m run, ski squat; participation/observation of aerobic energy system sports eg long distance running, long distance cycling

4 Know the impact of drugs on sports performance

Types of drugs: eg anabolic steroids, erythropoietin (EPO), growth hormone, cannabis, amphetamines, diuretics, beta blockers

Effect on sports performance: eg increase speed, increase stamina, increase strength, weight loss, increased alertness, slower heart rate

Negative impact of drugs: harmful effects on the body eg infertility, cancer, aggression, addiction; on sport; ethics; society

Assessment and grading criteria

In order to pass this unit, the evidence that the learner presents for assessment needs to demonstrate that they can meet all the learning outcomes for the unit. The assessment criteria for a pass grade describe the level of achievement required to pass this unit.

Assessment and grading criteria		
To achieve a pass grade the evidence must show that the learner is able to:	**To achieve a merit grade the evidence must show that, in addition to the pass criteria, the learner is able to:**	**To achieve a distinction grade the evidence must show that, in addition to the pass and merit criteria, the learner is able to:**
P1 describe the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems	**M1** explain the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems	
P2 investigate the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems, with tutor support [TW1, TW5]	**M2** independently investigate the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems	
P3 describe the long-term effects of exercise on the musculoskeletal system	**M3** explain the long-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems	**D1** analyse the short- and long-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems.
P4 describe the long-term effects of exercise on the cardiorespiratory system		
P5 describe two types of physical activity that use the aerobic energy system and two that use the anaerobic energy systems	**M4** explain the energy requirements of four different types of physical activity	
P6 investigate different physical activities that use the aerobic and anaerobic energy systems, with tutor support [TW1, TW5]		
P7 describe four different types of drugs used to enhance sports performance and their effects		
P8 describe the negative impact of drugs.	**M5** explain the negative impact of drugs.	

PLTS: This summary references where applicable, in the square brackets, the elements of the personal, learning and thinking skills applicable in the pass criteria. It identifies opportunities for learners to demonstrate effective application of the referenced elements of the skills.

Key	IE – independent enquirers	RL – reflective learners	SM – self-managers
	CT – creative thinkers	TW – team workers	EP – effective participators

Essential guidance for tutors

Delivery

This unit lends itself to a variety of delivery methods. Whilst theoretical knowledge must be taught, there should be as much practical activity as possible, as this will help to put the theory in context.

To explore the short-term effects of exercise on the body systems, learners can take a range of readings at rest. For learners to be at rest, heart rate and blood pressure readings should be taken after the learner has been lying down for a period of no less than five minutes. Heart rate can be taken manually or via heart rate monitors. Learners can then take part in a range of practical activities. After a period of around five minutes, and at designated intervals throughout the activity period, exercise readings can be taken. Learners could work in pairs or small groups. However, it is a good idea for every learner to have the opportunity to examine their own readings as this will help to engage and motivate them to learn. Physiological data, including heart rate, blood pressure and spirometry readings, can be taken. Various modes of exercise can be explored, for example cycling versus running.

The long-term effects of exercise could also be taught using practical components. If time and facilities are available, learners could take part in a training programme. Pre- and post-fitness tests could be taken and results analysed. This will help to demonstrate the physiological adaptations that can take place after a training programme. The areas that cannot be tested, such as heart size, increase in tendon strength etc, can be taught through theory and learner-centred research.

Energy systems are sometimes a challenging concept for learners to understand. Each energy system should be discussed and the sports that primarily use each energy system outlined. Learners can then investigate a range of sports that have not been discussed and work out which energy system predominantly supplies the energy for each. Learners can then take part in, or observe, a range of sports that use each energy system and compare and contrast each in order to gain a better understanding of them.

The impact of drugs on sports performance can be taught predominantly via theory with some video footage and media resources to supplement learning. Examples of the different types of drugs that could be examined are listed in the *Unit content*. However, new drugs can be examined. Learners could also have the opportunity to investigate a sportsperson of their choice who has been found to have been taking a drug and find out how it would have affected both their sports performance and their health. Both the ethics and the effects on society can be examined in relation to the selected sportsperson from reading media articles etc.

Outline learning plan

The outline learning plan has been included in this unit as guidance and can be used in conjunction with the programme of suggested assignments.

The outline learning plan demonstrates one way in planning the delivery and assessment of this unit.

Topic and suggested assignments/activities and/assessment
Introduction and overview of the unit
Learners take part in practical activities eg jogging for 15 mins, circuit training, football drills. When learners have completed the activity, tutor discusses the physiological changes that have occurred
Theory lesson: learners are split into groups, each with a different body system to discuss. Learners feedback to the rest of the group the short-term effects of exercise on their selected body system
Practical session: learners are shown how to use the different types of equipment for taking physiological measurements. Learners then work in small groups to test out the equipment and take physiological measurements from each other
Assignment 1: The Short-term Effects of Exercise on the Body (P1, P2, M1, M2). Practical assessments and recording data. Tutor introduces the assignment brief
Practical investigation into the short-term effects of exercise on the body (learner practical activities) and tutor observation
Assignment 2: The Long-term Effects of Exercise on the Body (P3, P4, M3, D1). Tutor introduces the assignment brief
Long-term effects of exercise on the musculoskeletal systems. Tutor-led session
Long-term effects of exercise on the cardiovascular system. Learner-centred research, feedback to the rest of the group
Long-term effects of exercise on the respiratory system. Learner-centred research, feedback to the rest of the group
Assignment 3: Energy Systems (P5, P6, M4). Practical assessments, tutor introduces the assignment brief
Anaerobic energy system alactic acid/phosphocreatine and the lactic acid system, sports that use these systems to provide energy. Theory session and practical activities to 'experience' the energy systems
Aerobic energy system and sports that use this system to provide energy. Theory and practical sessions
Calories used in taking part in different forms of physical activity. Learner-centred research
Assignment 4: The Impact of Drugs on Sports Performance (P7, P8, M5). Tutor introduces the assignment brief
Types of drugs and their effect on sports performance – theory
Impact of drugs on health – theory and DVD
Impact of drugs on sport. Tutor-led group discussion
Impact of drugs on society. Tutor-led/speaker/group discussion
Review of the unit

Assessment

Assessment evidence for this unit could be collated in a laboratory file/portfolio of evidence. For P1, learners need to describe the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory body systems.

For P2, learners need to carry out practical tests and activities to investigate what happens to the musculoskeletal, cardiovascular and respiratory systems in response to short-term exercise. To meet P2,

learners are expected to carry out these tests but may require tutor support during the testing processes, for example, physically helping them to find a pulse on the exercising person, helping to record data. If tutor support is required, then criterion M2 can not be achieved.

For P3, learners need to describe what happens to the musculoskeletal system after a long-term training programme. For P4, learners need to describe what happens to the cardiorespiratory system after a long-term training programme. For P5, learners need to describe accurately two different types of physical activity that use the aerobic energy system and two different types of physical activity that use the anaerobic energy systems. This can include one or both from the alactic/phosphocreatine energy system and one or both from the lactic acid energy system.

For P6, learners need to practically investigate different physical activities that use the aerobic and anaerobic energy systems, with tutor support. Practical activities can be supported by a tutor observation record. Witness testimony could be used to support group discussion to confirm learner understanding of how and when the energy systems are used in each selected activity. For P7, learners need to describe how four different types of drugs affect sports performance and, for P8, how drugs negatively impact on sport and society.

For M1, learners need to explain what happens during the first few minutes of exercise to each of the body systems described in P1.

For M2, learners need to independently carry out practical tests to investigate what happens to the musculoskeletal, cardiovascular and respiratory systems in response to short-term exercise.

For M3, learners need to explain what happens to the musculoskeletal, cardiovascular and respiratory systems after a long-term training programme. Learners need to analyse the short and longer-term effects of exercise on the three body systems in order to meet D1.

For M4, learners need to explain why four different types of physical activity require differing amounts of energy. For M5, learners need to explain how drugs negatively impact on a person's health and how they affect sport and society.

Programme of suggested assignments

The table below shows a programme of suggested assignments that cover the pass, merit and distinction criteria in the assessment and grading grid. This is for guidance and it is recommended that centres either write their own assignments or adapt any Edexcel assignments to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment method
P1, P2, M1, M2	The Short-term Effects of Exercise on the Body	You are considering getting a job in a fitness suite and need to know how exercise can affect the body systems.	Practical observation and laboratory report
P3, P4, M3, D1	The Long-term Effects of Exercise on the Body		Written report
P5, P6, M4	Energy Systems		Practical observation and laboratory report
P7, P8, M5	The Impact of Drugs on Sports Performance	Your sports coach has asked you to give a presentation to the junior squad, focusing on the effects of drugs and the impact that drugs have on sports performance.	PowerPoint presentation and witness statement

Links to National Occupational Standards, other BTEC units, other BTEC qualifications and other relevant units and qualifications

This unit forms part of the BTEC Sport sector suite. This unit has particular links with the following unit titles in the BTEC Sport suite and the BTEC Sport and Exercise Sciences suite:

Level 2 Sport	Level 3 Sport	Level 3 Sport and Exercise Sciences
Anatomy and Physiology for Sport	The Physiology of Fitness	Anatomy for Sport and Exercise
Fitness Testing and Training	Principles of Anatomy and Physiology in Sport	Sport and Exercise Physiology
Development of Personal Fitness	Fitness Training and Programming	Exercise, Health and Lifestyle
	Sports Coaching	Fitness Training and Programming
	Exercise, Health and Lifestyle	Instructing Physical Activity and Exercise
	Instructing Physical Activity and Exercise	Applied Sport and Exercise Physiology
		Sports Coaching

This unit links with the National Occupational Standards (NOS) for Achieving Excellence in Sports Performance at Level 3.

Essential resources

Learners require access to an area in which physical activity can take place. They will also require access to equipment for taking basic physiological measurements such as heart rate monitors, digital sphygmomanometers and spirometers. Access to other equipment, such as a cycle ergometer and/or treadmill, are desirable but not essential for unit delivery.

Employer engagement and vocational contexts

This unit focuses on the effects of exercise on the body systems and will give learners the background knowledge and skills needed to work in a fitness suite, leisure club or gym.

Centres are encouraged to develop links with local health education professionals and health fitness instructors so that learners can understand the importance of learning about how the human body works in order to pursue a career in the sport and fitness industry.

Indicative reading for learners

Textbooks

Adams M, Beashel P, Hancock J, Harris B, Phillippo P, Sergison A and Taylor I – *BTEC Level 2 First Sport Student Book* (Pearson, January 2010) ISBN 9781846906220

Adams M, Beashel P, Harris B, Johnson S, Phillippo P and Sergison A – *BTEC Level 2 First Sport Teaching Resource Pack* (Pearson, April 2010) ISBN 9781846907173

Hartigan S – *Essential GCSE PE for Edexcel* (Hodder Arnold, 2005) ISBN 9780340905586

Hazeldine R – *Fitness for Sport* (The Crowood Press, 2000) ISBN 9781861263360

Scott T – *GCSE PE for Edexcel* (Heinemann, 2001) ISBN 9780435506360

Sharkey B J – *Physiology of Fitness, 3rd Edition* (Human Kinetics, 1990) ISBN 9780873222679

Sharkey B J and Gaskill SE – *Fitness and Health* (Human Kinetics, 2006) ISBN 97807360561 44

Periodicals

Peak Performance – Peak Performance Publishing

Ultra-Fit Magazine – Ultra-Fit Publications (www.ultra-fitmagazine.com)

Websites

BBC Health	www.bbc.co.uk/health
British Heart Foundation	www.bhf.org.uk
Health Development Agency	www.nice.org.uk
NHS Information Centre	www.ic.nhs.uk/statsistics-and-data-collections

Delivery of personal, learning and thinking skills (PLTS)

The table below identifies the opportunities for personal, learning and thinking skills (PLTS) that have been included within the pass assessment criteria of this unit.

Skill	When learners are ...
Team workers	investigating the short-term effects of exercise on the musculoskeletal, cardiovascular and respiratory systems, with tutor support investigating different physical activities that use the aerobic and anaerobic energy systems, with tutor support

Functional Skills – Level 2

Skill	When learners are ...
Mathematics	
Select and apply a range of skills to find solutions	taking physiological data readings to find out what happens to the body during acute exercise
English	
Speaking and listening – make a range of contributions to discussions and make effective presentations in a wide range of contexts	discussing the negative impact of drugs on the human body, sport and society