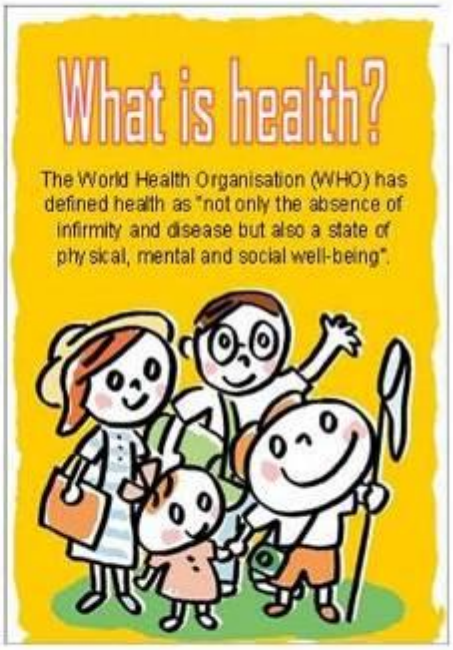
Physical Education (HKDSE)

Part IV: Fitness and Nutrition for Health and Performance in Physical Activities



Physical Education Section
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Learning Objectives

This part helps students explore the concepts of health-related fitness and sport-related fitness; the nutritional components and diet related to physical performance; and the interlocking relations among exercise, physical fitness, diet, health and chronic diseases. Such knowledge will enable students to recognise the importance of an active and healthy lifestyle and understand the concept of wellness mentioned in Part I. It can be linked to the discussion of factors affecting participation in sport and recreation (Part VIII).

Expected learning outcomes: Students will be able to

1. explain the definitions and components of “health” and “physical fitness”, with appropriate examples;
2. demonstrate the correct methods to evaluate physical fitness by using appropriate test protocols;
3. explain the role of physical activity in preventing non-communicable diseases;
4. explain the role of nutrition in maintaining health and enhancing physical performance;
5. critically analyse the various kinds of keep-fit programmes on the market; and
6. from a health maintenance perspective, evaluate and make recommendations on individual’s and other people’s lifestyles, including diet, weight control and engagement in physical activities.

Glossary

	Term	Description
1.	Active and healthy lifestyle 活躍及健康的生活模式	A way of living based on regular physical activity and a cluster of related healthy behaviours which leads to health, vigour and vitality as well as self-respect and control of one's destiny.
2.	Diabetes 糖尿病	A metabolic disorder in which the body's ability to secrete insulin for sugar metabolism is impaired. The individual is unable to utilise sugar properly to sustain muscular function.
3.	Hand grip dynamometer 手握力計	An instrument used for screening of grip strength.
4.	Endorphins 安多芬 / 內啡肽	Opium-like substances produced naturally in the brain that give a feeling of well-being. The production of endorphins is stimulated by many natural circumstances and also by profound exercise.
5.	Energy expenditure 能量消耗 / 能量支出	The units of energy expenditure commonly used are the kilojoule (metric system) and the kilocalorie (British system). The daily energy expenditure of an individual is mainly dependent on the intensity and duration of physical activity.
6.	Exercise prescription 運動處方	Personalised health advice for patients on exercising. The concept has been tested among groups of general practitioners in countries like Australia, the USA and the UK with favourable outcomes. In Hong Kong, the Department of Health (DH) conducted a randomised controlled trial to assess the effectiveness of incorporating this concept in medical recovery in 2003. The result showed significant improvement in clients' motivation to do exercise.
7.	Goniometer 測角器 / 測角儀	A device used for measuring the range of joint movement.

Glossary

	Term	Description
8.	Health / Wellness 健康 / 豐盛人生	According to the World Health Organization, health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Thus, we can interpret "health" as synonymous with "wellness".
9.	Hypertension 高血壓	The medical term for high blood pressure. Hypertension is a reading of blood pressure greater than 140 (higher pressure or systolic blood pressure) over 90 (lower pressure or diastolic blood pressure) mmHg with repeated measurements when the person is resting.
10.	Metabolism 新陳代謝 / 代謝作用	The chemical and physiological processes by which the body builds and maintains itself and by which it breaks down food and nutrients to produce energy.
11.	Non-communicable disease 非傳染性疾病	Diseases that are not capable of being passed from one person to another, for example, heart disease, lung cancer, etc.
12.	Obesity 肥胖 / 肥胖症	A medical condition in which excessive body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy.
13.	Overweight 超重	Overweight is often used interchangeably with pre-obese and is generally defined as having more body fat than is optimally healthy.
14.	Physical activity 體力活動 / 體能活動 / 身體活動	Any bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization 2009). An activity that involves physical exertion for exercise, recreation or competition. (Curriculum Development Council, 2007)

Glossary

	Term	Description
15.	Sedentary lifestyle 靜態的生活方式 / 久坐不動的生活方式	This is a lifestyle characterised by little or no movement; a habitual lack of physical activity.
16.	Skinfold caliper 皮摺計 / 皮摺脂肪夾	An instrument used to measure skinfold thickness.
17.	Stabilometer 穩定性測定儀 / 穩定性量測儀	An instrument used to measure sport-related dynamic balance.
18.	Sub-maximal workload 亞極量負荷 / 次最大負荷	Training or working below the maximum effort. Sub-maximal tests are often used to estimate the maximum capacity.
19.	Substance abuse 物質濫用	The harmful or hazardous use of psychoactive substances, including alcohol and illicit drugs.
20.	World Health Organisation (WHO) 世界衞生組織	The directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries and monitoring and assessing health trends.

Essential Concepts and Theories

A. Components of health

The World Health Organization (WHO) has defined health as "not only the absence of infirmity and disease but also a state of physical, mental and social well-being" *(See Fig. 4.1)*.

i) Physical health

It refers to a state of well-being that allows an individual to carry out daily tasks without the risk of health problems.

ii) Mental health

It is defined as a state of well-being in which every individual realises his or her own abilities; can cope with the normal stresses of life; and can work productively and fruitfully.

iii) Social health

It is the ability to interact well with people and the environment, and to have satisfying interpersonal relationships.

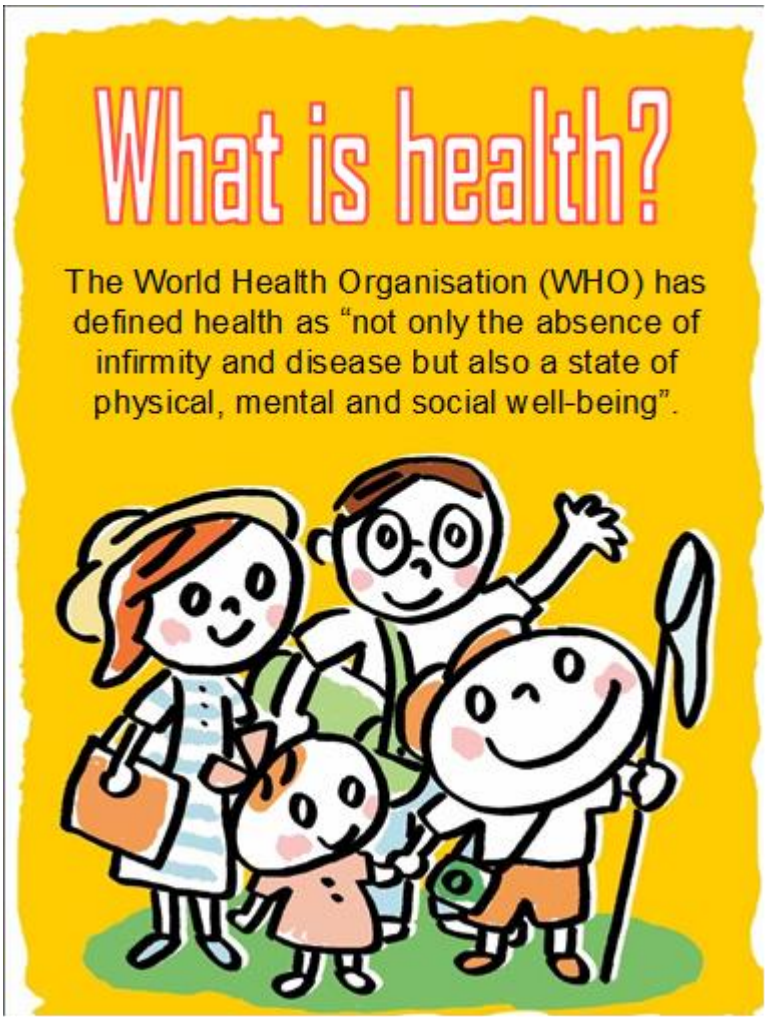

Fig. 4.1 What is health?

B. Definitions of fitness

i) Physical fitness

It is generally defined as “the ability to carry out daily tasks with vigour and alertness, without undue fatigue; and with ample energy to enjoy leisure-time pursuits and to meet unforeseen emergencies with a view to promoting health and preventing disease”. *(Source: WHO website)*

ii) Health-related fitness

It refers to the physical fitness level required for health maintenance. Its components include cardiorespiratory fitness, flexibility, muscular strength, muscular endurance and body composition.

iii) Sport-related fitness

It refers to the physical fitness level required for sporting activities. Its components include speed, agility, balance, coordination, power and reaction time.

C. Components and measurement of health-related fitness

i) Cardiorespiratory endurance

Also known as “aerobic fitness”, it is a condition in which the body's cardiovascular and respiratory systems function together, especially during exercise or work, to ensure that adequate oxygen is supplied to the working muscles to produce energy. It can be measured in a number of ways and can be broadly divided into laboratory testing and field testing. The maximal oxygen consumption ($VO_{2\ max}$), is a widely accepted standard measure for reflecting cardiorespiratory fitness. One of the common measuring unit is ml / kg / min. It refers to the maximum oxygen (ml) that one can consume in one minute per kg of body weight. To measure the VO_{2max}, a gas analysis system is needed to monitor the breathing condition and the heart rate of the testing subject *(See Fig. 4.2)*(Laboratory testing).

Fig. 4.2 VO_{2max} measurement on a treadmill with a gas analysis system

To measure the $VO_{2\ max}$, it is necessary to monitor the expired gases with a gas analysis system while the subject is exercising, which is costly and resource-demanding. Therefore, the following field tests are usually used to measure CR fitness (Field Testing):

- **Distance running**

The subjects run the greatest possible distance over a fixed period of time (for example, the distance covered in a 12-minute run / walk, a 9-minute run / walk) or the time required to complete a certain distance (for example, the time for completing a 1-mile run, a 1.5-mile run).

- **Step test**

To measure the number of heart beats during the first minute of recovery after a 3-minute stepping exercise.

ii) Flexibility

It is the range of motion of a joint or a group of joints. As flexibility is specific to individual joints and the surrounding tissues, there is no one valid test for general flexibility. For instance, the "sit-and-reach" test *(See Fig. 4.3)* is to measure the flexibility of the lower back muscles and hamstrings.

Fig. 4.3 Sit-and-reach test

According to the findings in a study[1] carried out by The Chinese University of Hong Kong, the advantages of using the modified back-saver sit-and-reach test *(See Fig. 4.4 & 4.5)* are as follows:

- It is valid and reliable.
- No sit-and-reach box is required. Only a meter ruler and a 30cm-high bench are needed. These items are readily available in most schools.
- Only one leg is tested at a time and the discomfort is minimised during the test.

Fig. 4.4 & 4.5 Modified back-saver sit-and-reach test

[1] Hui, S.C., & Yuen, P.Y. (2000). Validity of the modified back saver sit-and-reach Test: A comparison with other protocols. *Medicine and Science in Sports and Exercise. 32*(9), 1655-1659.

Increased flexibility can relieve the accumulated tension in muscles and enable an athlete to move more freely. At the same time, it helps prevent injury and facilitates faster recovery after training. Therefore, athletes should ensure that they have the desired flexibility for relevant sport. Swimmers, for example, should concentrate on flexibility in their groin, shoulders and back, whereas cyclists and runners should focus on their groin, hamstrings, calves and quadriceps. The flexibility of the hamstrings and lower back can be measured by the "sit-and-reach" test, whereas for other body parts a goniometer can be used to measure joint angles and the range of motion (*See Fig. 4.6 & 4.7*).

Fig. 4.6 & 4.7 Using a goniometer to measure the range of knee joint motion

iii) Muscular strength

It is the maximal force that a muscle or a muscle group is able to generate. The following are some common measurement methods:

One-repetition-maximum (1RM) measurement - It can be done in gymnasiums or laboratories by qualified personnel. This is the maximum weight that a person can lift for one repetition through several trials; adequate rest time between trials should be allowed for recovery.

Strength measurement - A dynamometer is used for strength tests. "Handgrip test" *(See Fig. 4.8)* is a common test item for measuring students' muscular strength.

Chinning, push-ups, etc - They are more traditional strength tests. They measure a combination of strength and endurance.

Fig. 4.8 Measuring muscular strength with a dynamometer

iv) Muscular endurance

It describes the ability of a muscle or a group of muscles to perform repeated muscular contractions against resistance. Related tests are to measure the subject's performance (the number of repetitions) at a sub-maximal workload. For example, **1 minute sit-ups** is a widely adopted test to measure the muscular endurance of the abdominal muscles.

v) Body composition

It refers to the relative distribution of fat, bones, muscles and water in the human body.

- **Skinfold measurement**

One of the easiest and most reliable methods of measuring body fat is the skinfold measurement technique. This involves using calipers to measure skinfold thickness at several sites on the body. *(See Fig. 4.9)* According to the American Council of Sports Medicine[2], these

[2] American College of Sports Medicine. (2006). *ACSM's guidelines for exercise testing and prescription* (7th ed.). Philadelphia: Lippincott Williams & Wilkins.

sites include the biceps brachii, triceps brachii, subscapular, chest, mid-axillary, abdomen, suprailium, thigh and calf. A formula is then used to calculate the data from all the measurements to generate a reading of body fat (which is given as a percentage of the overall body mass).

Fig. 4.9 Skinfold measurement of triceps

- **Bioelectrical Impedance Analysis (BIA)**

It is a simpler and high valid method to measure body composition. BIA involves the placement of two electrodes on the subject's legs. A very low, safe electrical signal is sent from metal electrodes through the subject's feet to the subject's legs and abdomen. The flow of the current is affected by the amount of water in the body. The device measures how this signal is impeded through different types of tissues. Tissues that contain large amounts of fluid, such as blood, have high conductivity, but fat and bone slow the signal down. The monitor provides estimates of body water from which body fat is calculated based on selected equations.

Fig. 4.10 Bioelectrical Impedance Analysis (BIA)

- **Body Mass Index (BMI)**

One of the common indicators which describes body fatness, it is a simpler but less valid method to measure body composition. According to the Department of Health, the BMI between 18.5 and 22.9 is a normal range for Asian adults. BMI can be calculated in the following way:

$$\text{BMI} = \frac{\text{Weight (in kilograms)}}{\text{Height (in meters)} \times \text{Height (in meters)}}$$

D. Components and measurement of sport-related fitness

i) Speed

It refers to the time required to travel from one location to another. It is commonly assessed by sprinting tests (for example, 50m run).

ii) Agility

It refers to the ability to perform quick starts, sudden stops, direction changes, etc. It is commonly assessed by shuttle runs (for example, Zig-zag run; *See Fig. 4.11*).

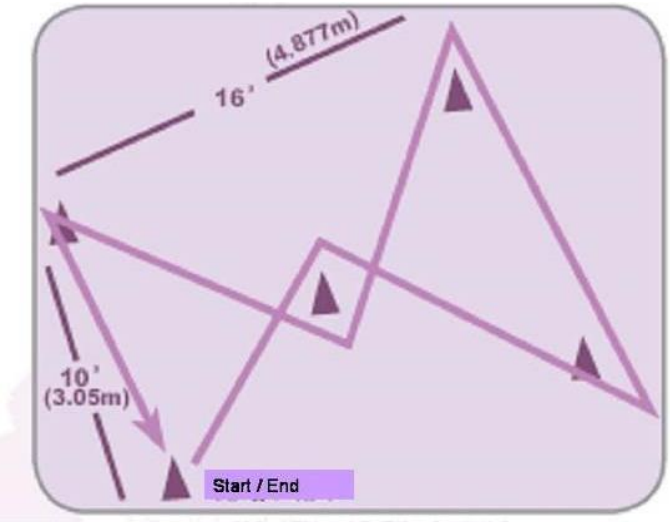

Fig. 4.11 "Zigzag" run

iii) Reaction time

It refers to the time between receiving a command and initiating a corresponding action (for example, a runner exerts a thrust out of the starting block as soon as possible following a signal). Due to the very short time span for reaction, an electronic apparatus is required to record the reaction time accurately.

iv) Balance

It refers to controlling body parts to maintain stability. It can be tested by requiring the subject to stand on one leg with eyes closed *(See Fig. 4.12)* or stand on a stabilometer *(See Fig. 4.13)*.

Fig. 4.12 Standing on one leg with eyes closed

Fig. 4.13 A stabilometer

v) Coordination

It refers to controlling different body parts to perform a movement as required, the quality of movements is usually assessed through observation. 30 seconds “Alternate Wall Toss Test” is a test for assessing hand-eye coordination.

vi) Power

It is defined as the ability to produce maximum force in the shortest time. The components of speed and strength combine to produce power which allows a person to execute explosive movements. Power can be measured by a vertical jump, a standing long jump, throwing an implement or hitting a ball.

E. Food and nutrition

i) Carbohydrates

They are organic components composed of carbon, hydrogen and oxygen. They provide a continuous supply of energy to the body's cells in the form of glucose.

- **Types**

- **Simple Carbohydrates (Monosaccharide & Disaccharides)**

They are single and double sugar molecules which are the sources of fast energy to the working muscles, as they are broken down easily by the body. Examples of monosaccharides include glucose, while sucrose is an example of a disaccharide, both of them can be found in most fruits. In addition, lactose, which is found only in natural milk, is also a simple carbohydrate.

- **Complex Carbohydrates (Polysaccharides)**

They are three or more sugar molecules linked together and they come from either plant or animal sources. Such types of carbohydrates can be found in daily foods like potatoes, cereals and apples. These types of carbohydrates are not directly absorbed by the body easily. They must be broken down into the smallest possible units before absorption.

- **Functions**

- **As energy source** – The energy, derived from the breakdown of blood glucose, is used by the muscles to perform work.
- **As protein sparer** – An adequate intake of carbohydrates is vital as it ensures sufficient energy for consumption, body growth and tissue repair.
- **As fuel for the Central Nervous System (CNS)** – Neurons in the central nervous system need glucose to function properly. During prolonged exercise, when the blood glucose level is significantly reduced (hypoglycaemia), the CNS becomes fatigued which can lead to physical and mental weakness, hunger and dizziness. Sustained hypoglycaemia can trigger unconsciousness and even cause brain damage.

- **The recommended intake for the World Health Organization (WHO)**

Carbohydrates can be obtained from foods such as rice, noodles, potatoes, sweet potatoes, fruits, and vegetables. The daily intake of carbohydrates should account for 55% - 75% of the total caloric intake.

ii) Proteins

They are chemical compounds composed of chains of amino acids.

- **Functions**

- The main function of protein is to assist in body growth and to repair damaged body tissues.
- Protein plays a part in regulating chemical reactions within the body and assists in plasma transport and blood clotting.
- Protein is used as body fuel when there is insufficient energy supply from carbohydrates and fat.

- **The recommended intake for the World Health Organization**

Protein can be obtained from foods such as meat, fish, eggs, beans and nuts. It is recommended that the daily intake of protein should account for 10% - 15% of the total caloric intake.

iii) Fats (Lipids)

Also known as lipids, they are critical nutrients that play a very important role in the human body. Lipids include oils, fats and wax.

- **Types**

- **Saturated Fatty Acids**

These contain only single bonds between carbons, with a great number of hydrogen atoms. They are recognised in a solid state at room temperature and found mostly in beef, poultry,

pork, egg yolk and dairy products.

- **Unsaturated fatty Acids**

These contain one or more double bonds between carbons, which reduce the number of hydrogen atoms that can bind to the chain. They can be found in sunflower seeds, soya beans and corn oil.

- **Trans fatty Acids**

They are produced when liquid oils are processed “hydrogenation” and they are generally in solid form. A small amount of natural trans fatty acids can be found in cattle and sheep milk. An excessive intake of the acids will increase the risk of heart disease.

- **Cholesterol**

It is a kind of sterols, a type of lipids. It can form vitamin D and some hormones. It can be found in eggs and squids. An excessive intake of cholesterol will increase the risk of heart disease.

- **Functions**

Among many important functions of fat in the human body, the most important one is to provide energy in the form of triglycerides in the Krebs Cycle. It also protects the internal organs against shock and acts as a source of insulation. It also plays an important role in maintaining body heat, hunger suppression, and is a transportation agent of vitamins around the body.

- **The recommended intake for the World Health Organization**

Fats can be obtained from foods such as meat, fish, eggs, oil and nuts. Daily intake of fats should account for 15% - 30% of the total caloric intake.

iv) Vitamins

They are chemical compounds needed for health and growth. They must be obtained from food and be transported to all parts of the body by the circulatory system. The amount of vitamins required by the body is very small. It is vital for health maintenance, energy

production and metabolism. There are different types of vitamins. Vitamins B and C are water -soluble and cannot be stored in the body. Vitamins A, D, E and K are fat-soluble and are stored in the body. Vitamins have various functions *(See Table 4.1)* that help to regulate metabolism, to prevent chronic diseases (such as heart disease and cancer), and to maintain normal appetite, mental health, and immunity.

Vitamins	Major Physiological functions in the human body	Daily requirement for adults	Food sources	Effect of deficiency
A	keeps skin healthy and maintains normal eyesight	700-900 µg	egg yolk; green or yellow vegetables (for example, sweet potatoes); fruits (for example, mangos); liver, butter and olive oil	night blindness, skin soreness
B	produces energy in all cells	1.5 mg	viscera, fish, whole grains, yeast, eggs, spinach, green leafy vegetables, beans and groundnuts	various diseases, including heart failure
C	helps heal wounds, maintains the health of muscles, teeth and bones, protects against colds	75 mg	fresh fruits and vegetables such as tomatoes and sweet potatoes	scurvy
D	helps strengthen bones	5µg	fish oils, liver, milk and appropriate skin exposure to sunlight	rickets
E	as an antioxidant to prevent cell damage	15mg	green leafy vegetables, whole grains and cottonseed oil	impairment of the immune response
K	helps blood clotting	undecided	liver, leafy vegetables, fruits and meat	blood clotting disorders

Table 4.1 Important vitamins from diet

v) Minerals

They are inorganic compounds which can be obtained from food. Minerals such as calcium, sodium and potassium are essential for the normal growth and maintenance. Some minerals, like iron, can be found in body fluid, and are called electrolytes *(See Table. 4.2)*.

	Major Physiological functions in the human body	Daily requirement for adults	Food sources	Effect of deficiency
Calcium	strengthens bones and teeth, maintains muscle contraction and relaxation, helps blood clotting	1000 - 1300 mg	dairy products, milk, eggs, fish, soya beans and leafy green vegetables	fragile bones
Fluoride	strengthens bones and teeth	3 - 4 mg	milk, tooth paste with fluoride	tooth decay
Iron	helps blood to carry and transport oxygen	8 - 18 mg	cereal, liver, eggs, red meat, groundnuts, plantain, raisins, cocoa	anaemia
Magnesium	keeps bones healthy, helps muscle contraction and transmission of nerve impulse	300 - 400 mg	green vegetables, milk, meat, beans, shell food	malfunction of muscles
Potassium	helps muscle contraction and transmission of nerve impulse	2000 mg	all foods, especially meats, vegetables, milk	malfunction of heart muscles and other muscles
Sodium	the major electrolyte in the human body, maintains extracellular fluid balance	less than 2000 mg	most foods, table salt, soya sauce	dehydration, muscle cramps
Phosphorous	maintains the health of bones and balance of blood fluids	700mg	cheese, oatmeal, liver, kidney	fragile bones and muscle weakness
Iodine	produces thyroid hormones	120 - 150 mg	most food and drinking water	goiter, retarded mental and physical development in children

Table 4.2 Minerals from diet

vi) Fibre

It is only found in plants and is indigestible in the human body. It can be found in grain, cereal, beans, peas, vegetables and fruits. It also plays a part in the facilitation of bowel function and may reduce the risk of heart diseases.

vii) Water

It is essential for the survival of all bodily tissues. About 55% - 65% of the human body's weight is made up of water. The functions of water include helping digestion, providing lubricant for joint movements, regulating body temperature, acting as a medium to transport nutrients around and removing waste from the body.

viii) Balanced diet

It is extremely important for the human body to take in the essential nutrients to maintain its normal functions. A balanced diet refers to the selection of foods with appropriate portions to provide adequate nutrients and energy for the growth of body tissues, strengthening the immune system and keeping a healthy body weight. The "Healthy Eating Food Pyramid" (See Fig. 4.14) serves as a guide for healthy eating to remind people to maintain a normal body weight and a regular intake of various nutrients in appropriate portions. In 2011, the United States Department of Agriculture has published "My Plate" to help people to adopt healthy eating habits. The latest edition of the "Dietary Guidelines for Americans 2025–2030" advocates 'eating real food', placing the focus on the source of food and the extent to which it has been processed.

Reference: https://cdn.realfood.gov/DGA.pdf

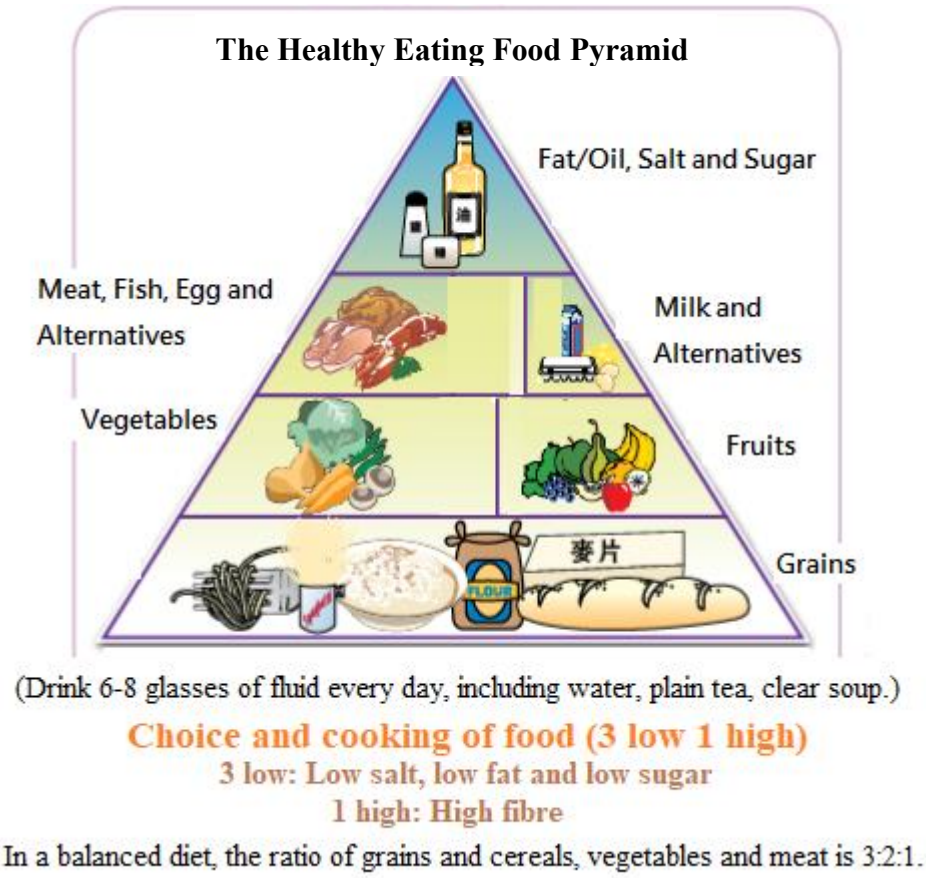

Fig. 4.14 The Healthy Eating Food Pyramid

ix) Nutrition and exercise performance

A balanced diet provides an individual with all the nutrients required for regular exercise. However, more physically active individuals who regularly take part in vigorous sports activities require larger quantities of foods to provide extra energy needed.

F. Weight control

There are many advertisements and teenage magazines displaying pictures of slim young people, particularly young females, to promote slimness as the ideal of beauty. These may urge people to attain a slim body shape. In fact, people who wish to lose weight should acquire relevant knowledge beforehand and follow the correct method. Individuals can control their body weight by regulating their energy input and output, i.e. taking a balanced diet and doing regular exercises. Proper weight control can prevent non-communicable diseases, such as heart disease and Type II Diabetes. It is also important for achieving health and wellness.

i) Energy balance

The basic concept of weight control is to strike a balance between the energy input and output *(See Fig. 4.15)*. The following three ways serve as useful references for losing weight:

- Reducing the daily caloric intake to the level below the daily expenditure level
- Maintaining the daily caloric intake and increasing the daily energy expenditure level
- Decreasing the daily caloric intake and increasing the daily energy expenditure

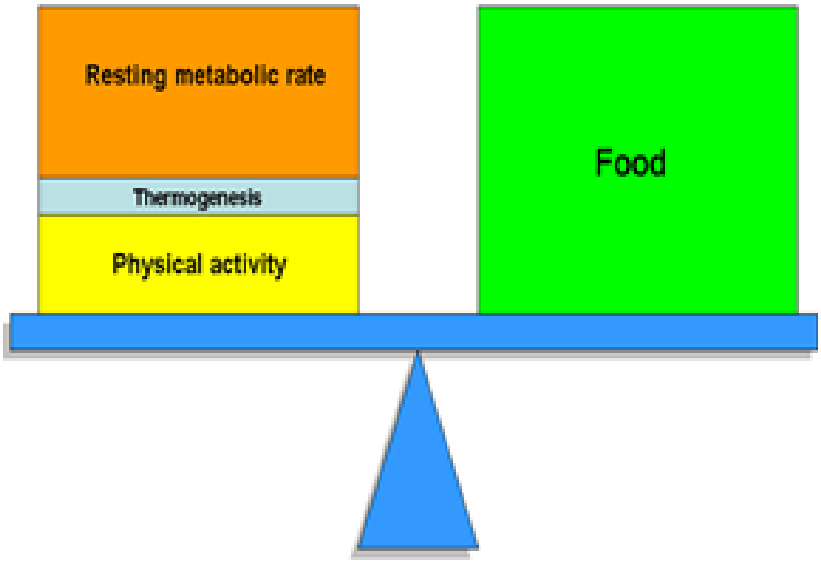

Fig. 4.15 The energy output (rest + thermogenesis + physical activity) = The energy input (food)

ii) Overweight and obesity

The WHO defines overweight and obesity as abnormal or excessive fat accumulation that presents a risk to health. In general, a person with a Body Mass Index (BMI) of 30 or above (25 or above for Asian adults) is generally considered "obese". A BMI of 25 – 29.9 for adults (23 – 24.9 for Asian adults) is defined as being "overweight". Yet, in some cases, such as body builders, overweight for some people may not increase the risk.

In general, "overweight" or "obesity" occurs due to the imbalance between the energy input and output, resulting in excessive body fat. Apart from adopting a sedentary lifestyle and having an excessive energy intake, other factors may also give rise to obesity, such as heredity factors and the effects of illnesses or drugs. Obesity brings an increased risk of hypertension, elevated blood sugar and cholesterol levels.

iii) Weight control

Points to note for losing weight:

- Weight loss should not exceed 1 kg (about 2.2 lb) per week.
- Increase the level of physical activity and adopt a mild restriction of caloric intake, but the intake should not be less than 800 Kcal per day.
- Do at least 150 minutes of moderate intensity exercise per week.

Points to note for gaining weight:

- Consume mainly complex carbohydrates (for example, rice, bread) to gain additional calories; increase the caloric intake by 200 to 1000 Kcal per day.
- Conduct resistance training for accumulating fat-free body mass.

G. Healthy Behaviour

Many illnesses and diseases are the results of unhealthy lifestyles and habits such as cigarette smoking, low physical activity levels, imbalanced diets, substance abuse, etc. The WHO also recognises that a healthy diet and regular physical activities are major factors in promoting and maintaining good health. In May 2004, the WHO formulated and implemented the "Global Strategies on Diet, Physical Activity and Health" and called for "the development of global and national strategies on diet, physical activity and health within an integrated approach to non-communicable disease prevention and health promotion" *(Source: WHO website)* for reducing death and disease worldwide.

i) Diet – The Department of Health recommends the following principles of healthy eating:

- Choose a variety of food and eat grains as the largest portion of food in every meal
- Eat a lot of vegetables and fruits
- Eat a moderate amount of milk, meat, fish, egg and their alternatives (including dry beans)
- Reduce the intake of foods with high fat/oil, salt and sugar content as well as those preserved and processed foods
- Drink an adequate amount of fluid every day (including water, tea, clear soup, etc)
- Have regular meals at regular times

ii) Exercise and physical activity level

The Department of Health recommends the following physical exercise patterns for general healthy people (*See Fig. 4.15*):

- Exercise mode – Engage in physical activities which involve large muscle groups, for example, walking, jogging, running, biking, stepping, rowing, etc.
- Exercise intensity* – Work at moderate or vigorous intensity.
- Exercise duration* – Accumulate 30 minutes or more each day.
- Exercise frequency* – Work at least three days, but preferably five days per week.
- Exercise progression – Depends on each individual's abilities, goals and preferences.
- Special considerations – The activities should align with the individual's goals, be enjoyable and easy to perform. They should also be challenging, but without high risk of injury, or they would not cause excessive fatigue or muscle soreness.

According to the World Health Organization Guidelines on physical activity and sedentary behaviour: Reference: https://www.change4health.gov.hk/en/physical_activity/guidelines/index.html

	Children and adolescents aged 5-17 years	**Healthy adults aged 18-64 years**	**Healthy adults aged 65 years and above**
Time, intensity and type of exercises	➢ should do at least an average of 60 minutes per day of moderate-to-vigorous intensity, (mostly aerobic, physical activity), across the week.	➢ should undertake regular physical activity. ➢ should do at least 150–300 minutes of moderate-intensity aerobic physical activity; or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week as these provide additional health benefits.	
Time, intensity and type of exercises that would bring about additional health benefits.	➢ should incorporate vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, at least 3 days a week.	➢ should also do muscle-strengthening activities at moderate or greater intensity that involve all major muscle groups on 2 or more days a week. ➢ may increase moderate-intensity aerobic physical activity to more than 300 minutes; or do more than 150 minutes of vigorous-intensity aerobic physical activity; or an equivalent combination of moderate- and vigorous-intensity activity throughout the week for additional health benefits.	
Amount of time spent being sedentary	➢ should limit the amount of time spent being sedentary, particularly the amount of recreational screen time. (e.g. watching TV and playing video games)	➢ should limit the amount of time spent being sedentary. Replacing sedentary time with physical activity of any intensity (including light intensity) provides health benefits, and ➢ should aim to do more than the recommended levels of moderate- to vigorous-intensity physical activity for reducing the detrimental effects of high levels of sedentary behaviour on health.	
Other precaution			➢ as part of their weekly physical activity, older adults should do varied multicomponent physical activity that emphasizes functional balance and strength training at moderate or greater intensity, on 3 or more days a week, to enhance functional capacity and to prevent falls.
			➢ should be as physically active as their functional ability allows, and adjust their level of effort for physical activity relative to their level of fitness.

iii) Rest and relaxation

It is important to have sufficient time for rest and relaxation between exercise workouts so that the body can go through the essential stages of adaptation to physical activities.

iv) Substance abuse

It refers to the taking of a substance without following medical advice and prescription, such as drug abuse, smoking or consuming too much alcohol. Substance abuse is harmful to health, including negative psychological impacts. As reflected by some youngsters, the reasons for using drugs are boredom and stress, the desire to have excitement and the wrong belief that taking drugs is a trendy practice. To meet the needs of these young people and help them lead an active and healthy lifestyle, one of the best approaches is to encourage them to participate in physical activities. The young people will benefit from relaxation, enjoyment, satisfaction, confidence, recognition and, more importantly, a healthy body.

v) Posture

Many experts agree that there is no absolutely correct posture. Good posture helps minimise stress on the joints and lumbar and decrease the back and neck pain, which can lead to an overall promotion of health.

H. Role of physical activity in the prevention of non-communicable diseases

Physical activity has an important role to play in the prevention of non-communicable diseases. The American Heart Association has found that the emergence of adverse health conditions such as coronary heart disease (CHD) and diabetes are directly related to the adoption of a sedentary lifestyle. According to the different research reports, regular physical activity is essential for preventing a number of chronic diseases such as hypertension, CHD, stroke, diabetes, many kinds of cancer, depression, obesity and osteoporosis.

There are a number of risk factors associated with CHD that can be reduced by increasing an individual's physical activity level. Such factors include:

- elevated blood lipid levels
- hypertension
- excessive body fat
- tension and stress
- pulmonary function abnormalities
- hypokinetic degeneration

It is clear that diet and physical activity play an important role in achieving a healthy mind and body. Health status can be significantly improved by adopting a more physically active lifestyle and a balanced diet, which can prevent and reduce the risk of non-communicable diseases.

Examples of Enquiry Activities

Themes		Activities
1	Healthy lifestyle	Reflection: • Give examples of your health conditions in physical, mental and social aspects. • Give examples of how your lifestyle has contributed to or has helped maintain your good health in physical, mental and social aspects. P-I-E (Planning – Implementation – Evaluation): • Draft a charter of leading a healthy lifestyle. • Collect comments from your classmates on the above-mentioned charter and make amendments if necessary. • Take actions according to the charter for two months, write a reflection report (in about 500 words) and then share the experience with your classmates. Project learning: • To conduct a project on "the Role of Physical Activity in the Prevention of Non-Communicable Diseases".
2	Diet	Information collection and analysis: • Analysis of diet *(See additional information(1))*
3	Physical activity level	Information collection and analysis: • Analysis of daily activities *(See additional information(2))*
4	Weight control	Information collection and analysis: • Collect five to eight advertisements on weight loss plans from newspapers or magazines. • Analyse the strategies used in the above-mentioned

Examples of Enquiry Activities

Themes		Activities
		advertisements to attract readers. • Carefully study the advertisements and identify the true and untrue messages. • Discuss why so many people are willing to spend money on various weight loss plans. Reflection: • Review your personal conditions to see if you need weight control, and explain why.
5	Physical fitness tests	Information collection: • Measure your flexibility using the modified back-saver sit-and-reach test. *(See additional information(3))* • Try the vertical jump test. *(See additional information(4))* Reflection: • Will the results be different if the above two tests are conducted by other testers? Why? • Suggest possible ways to ensure that the results will be the same even if the tests are conducted by other testers.

Examples of enquiry activities (Additional information) (1): Analysis of diet

Objective: To deepen students' knowledge of proper eating habits.

Description: Every student keeps a diary of food and fluid intake over a 3-day period. The portions of fat, protein and carbohydrates consumed are recorded and analysed to see if changes to the diet habits are necessary.

Implementation:

- The teacher distributes a food chart for students to fill in.
- The teacher draws students' attention to the importance of having complete and accurate records of every food and fluid item consumed on the food chart. The results and data can be used for class discussion. The following is an example of some serving sizes for different food groups:

Food intake per day					
Day(week)	**Grains**	**Vegetables**	**Milk / dairy**	**Meats & beans**	**Oils**
Day 1 ( )					
Breakfast					
Lunch					
Dinner					
Total (g)					
Day 2 ( )					
Breakfast					
Lunch					
Dinner					
Total (g)					
Day 3 ( )					
…					

Instructions:

- Before the activity, the teacher introduces to students the food sources of various nutrients and their recommended daily intake.
- Students should understand the components of carbohydrates, fat and protein in each food serving. They may refer to the following link for identification of different components in food.

  https://www.cfs.gov.hk/english/nutrient/fc-introduction.php
- Give clear instructions to students on how to keep accurate records of all the food consumed. Based on the records and the relevant guidelines, they may decide if changes to their diet are necessary.

Examples of enquiry activities (Additional information) (2): Analysis of daily activities

Objective: To understand one's physical activity pattern and to improve one's daily living habits.

Description: Over any three days in a week, students keep records of the type, time spent and intensity (low / moderate / vigorous) of all the activities under the following headings:

- Bodily needs (sleeping, eating, etc)
- Work (at home, at school, etc)
- Leisure

Students may refer to the following WHO website for more details about the intensity of physical activity:

https://www.who.int/news-room/fact-sheets/detail/physical-activity

The students may use a pie-chart to collate the information, which allows easy comparisons among students. Then use the findings for thematic talks on healthy living habits.

Weekly Distribution of Physical Activity Time			
	Bodily needs	**Work**	**Leisure**
Examples	• Breakfast (low-10 minutes) • … • Sleeping (480 minutes)	• Walking to the bus stop (moderate-10 minutes) • Taking a bus to school (low-30 minutes) • …	• Reading newspapers – low-30 minutes) • Football training (moderate-30 minutes; and vigourous-60 minutes) • …
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Saturday			
Sunday			
Total (minutes)			

Examples of enquiry activities (Additional information) (3):

Modified back-saver sit-and-reach test

Objective: To help students master a safer alternative flexibility test.

Description: In pairs, students conduct the modified back-saver sit-and-reach test to measure the flexibility of the lower back and hamstrings. Students record the results and work out a class average.

Implementation:

- Students may conduct the activity in a gymnasium or a spacious classroom, and pay particular attention to the correct testing technique.
- The teacher should supervise the process, give timely feedback to students' enquiries and correct their posture when necessary.

Instruction:

- Before the activity, the teacher should remind students to be serious in acting as the subject and the tester.

Examples of enquiry activities (Additional information) (4): Vertical jump

Objective: To enable students to gain practical experience in conducting a fitness test and recording the data.

Description: The vertical jump test is to measure the strength and power of the legs. Students work in pairs, taking turns to be the subject and the tester. The teacher explains and demonstrates how the test is conducted.

Implementation:

- This test may take place in a gymnasium or a classroom if space permits.
- Measure the standing reach height - stand by a wall with either side of the shoulder close to it, reach up with the hand closest to the wall.
- Measure the height of the jump – jump vertically as high as possible and touch the wall at the highest point with the fingers.
- Recording the testing results (net height) – calculate the difference between the standing reach height and the jump height. Record the results of three attempts.
- Generate a bar chart with the results.

	Standing Reach Height	Jump Height	Test Results (net height)
1st Attempt			
2nd Attempt			
3rd Attempt			

Instruction: Before the test, students must practise the proper jump and reach technique.

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