

Student name: Nejma Begum

Student ID: 2419975

Lecturer Name: Gillian Weaver and Robert Nartowski

Module Code: BMHP5023

Module Name: Introduction to Physiology

Contents

Introduction.....	2
Describe the Structure of the Respiratory System and Explain the Process of Mechanical Respiration	3
Structure of the Respiratory System.....	3
Upper Respiratory Tract.....	3
Lower Respiratory Tract.....	3
Muscles Involved in Breathing.....	4
Inspiration (Breathing In).....	4
Expiration (Breathing Out).....	4
Explain the Process of Gas Exchange in the Lungs	5
Gas Exchange in the Alveoli	5
Movement of Oxygen into the Blood.....	5
Removal of Carbon Dioxide	5
Importance of Efficient Gas Exchange in Asthma	5
Explain How Increased Levels of Irritants in the Respiratory System Lead to Swelling in the Lung Tissue and the Impact of This on Respiration.....	6
Common Respiratory Irritants	6
Inflammatory Response in the Airways.....	6
Effect on Lung Tissue and Respiration	6
Examine How Recording and Tracking Respiratory Functions Helps Individuals with Asthma to Monitor and Safely Manage Their Condition	7
Monitoring Respiratory Function.....	7
Peak Flow Readings.....	7
Asthma Action Plans.....	7
Benefits of Regular Monitoring	7
Evidence-Based Recommendations on Lifestyle Changes to Improve Asthma	8

Smoking and Vaping Cessation	8
Avoiding Asthma Triggers	8
Physical Activity and Exercise	8
Vaccinations and Infection Prevention	8
Medication Adherence and Regular Reviews.....	9
Conclusion.....	10
References	11

Introduction

A frequent chronic respiratory disease that damages the lungs airways is asthma. It makes it harder for air to enter and exit the lungs by causing bronchial tube irritation and constriction. Although symptoms can differ from person to person, they frequently include shortness of breath, coughing, wheezing, and tightness in the chest. According to the Global Initiative for Asthma (GINA), 2024, these symptoms frequently get worse during an asthma attack, sometimes referred to as an exacerbation, which may necessitate immediate medical attention.

Environmental and genetic factors work together to cause the development of asthma. People who have allergies or asthma in their family are more likely to get the illness. Pollen, dust mites, mould, pet dander, tobacco smoke, air pollution, and respiratory illnesses are examples of environmental triggers. Lifestyle choices including smoking, vaping, and being in crowded places where respiratory infections can spread quickly can make asthma symptoms more common and severe in teenagers and young adults (NICE, 2021). For certain people, asthma can also be triggered by exercise, chilly air, or emotional stress.

Describe the Structure of the Respiratory System and Explain the Process of Mechanical Respiration

Structure of the Respiratory System

The respiratory system oversees giving the body oxygen and eliminating carbon dioxide, a waste product that is created during cellular respiration. According to Tortora and Derrickson (2021), carbon dioxide must be eliminated in order to preserve the body's natural acid-base balance, whereas oxygen is necessary because body cells use it to create energy.

Upper Respiratory Tract

The mouth or nose allow air to enter the respiratory system. Before the air travels via the pharynx (throat) and larynx (voice box), the nose aids in filtering, warming, and moistening it. The larynx, which houses the voice chords, shields the airway during swallowing by keeping liquids and food from getting into the lungs.

Lower Respiratory Tract

The trachea, which is held open by cartilage rings, is where air then passes. The trachea splits into the left and right bronchi, one of which enters each lung. The bronchi in the lungs divide into smaller bronchi and bronchioles on a regular basis, forming a branching network that distributes air throughout the lung. Gas exchange occurs in microscopic air sacs termed alveoli at the end of bronchioles (Marieb and Hoehn, 2023).

Muscles Involved in Breathing

A double layered membrane called the pleura envelops the lungs, which are shielded by the rib cage. Pleural fluid, which is found between these layers, lessens friction as the lungs expand and contract while breathing. The primary muscle used in breathing is the diaphragm, a dome-shaped muscle situated beneath the lungs. During breathing, the external intercostal muscles, which are situated in the space between the ribs, also aid by moving the rib cage.

Inspiration (Breathing In)

The physical process of bringing air into and out of the lungs is called mechanical respiration, sometimes referred to as ventilation. The external intercostal muscles flex during inspiration, raising the ribs outward and upward as the diaphragm contracts and flattens. As a result, the chest cavity's capacity expands, and the lungs' internal pressure drops below air pressure. Consequently, until the pressure equalises, air normally enters the lungs (Hall and Hall, 2021).

Expiration (Breathing Out)

The diaphragm and intercostal muscles relax during expiration, enabling the chest wall and lungs to return to their resting positions. As a result, the thoracic cavity's volume shrinks and the lungs' internal pressure rises, driving carbon dioxide-containing air out of the body. Because it takes greater work to move air in and out of the lungs during activity or an asthma attack, extra muscles in the neck, shoulders, and belly may be used to help with breathing.

Explain the Process of Gas Exchange in the Lungs

Gas Exchange in the Alveoli

The alveoli, which are tiny air sacs at the extremities of the bronchioles, are where gas exchange takes place. The alveoli are encircled by a web of capillaries and have extremely thin walls. Because of their vast surface area, they facilitate the effective exchange of carbon dioxide and oxygen between the blood and the lungs (Marieb and Hoehn, 2023).

Movement of Oxygen into the Blood

The alveoli receive oxygen when air is inhaled. The blood in the nearby capillaries has a lower oxygen content than the alveoli. As a result, oxygen diffuses into the blood through the thin walls of the capillaries and alveoli. After entering the bloodstream, oxygen attaches itself to haemoglobin in red blood cells and is carried to bodily tissues where it is utilised to generate energy (Hall and Hall, 2021).

Removal of Carbon Dioxide

Cells make carbon dioxide during metabolism, and the blood carries it back to the lungs. Because carbon dioxide is more concentrated in capillary blood than in alveoli, it diffuses into the latter. Carbon dioxide is released from the lungs and eliminated from the body during exhalation. According to Tortora and Derrickson (2021), this procedure keeps dangerous waste gases from accumulating and aids in maintaining a normal blood pH.

Importance of Efficient Gas Exchange in Asthma

Inflammation and an overabundance of mucus can constrict the airways and decrease airflow to the alveoli in asthmatics. This makes it harder to efficiently eliminate carbon dioxide and reduces the quantity of oxygen that reaches the circulation. Because gas exchange becomes less effective during an asthma episode, people may have chest tightness, wheezing, and shortness of breath. Low oxygen levels can cause weariness, light headedness, and respiratory distress in extreme situations, underscoring the significance of efficient asthma management and therapy (GINA, 2024).

Explain How Increased Levels of Irritants in the Respiratory System Lead to Swelling in the Lung Tissue and the Impact of This on Respiration

Common Respiratory Irritants

Numerous chemicals can aggravate asthma symptoms by irritating the respiratory system. Cigarette smoke, vaping products, dust, pollen, mould, pet dander, air pollution, and respiratory illnesses like the flu and common cold are examples of common irritants. These irritants can exacerbate asthma symptoms by causing inflammation in the airways (NICE, 2021).

Inflammatory Response in the Airways

The immune system releases inflammatory substances including histamine and leukotrienes in response to irritants entering the lungs. These chemicals result in swelling and inflammation of the bronchi and bronchioles' lining. Furthermore, bronchoconstriction occurs when the smooth muscles that surround the airways tighten. Additionally, the cells that line the airways create an excessive amount of mucus, which narrows the airways even more (McCance and Huether, 2019).

Effect on Lung Tissue and Respiration

The diameter of the airways is decreased by bronchoconstriction, increased mucus production, and swelling of the lining of the airways. Breathing becomes more challenging as a result of the reduced airflow into and out of the lungs. Wheezing, coughing, tightness in the chest, and shortness of breath are common symptoms of asthma. Reduced airflow during severe asthma attacks can seriously lower blood oxygen levels and hinder carbon dioxide elimination, resulting in respiratory distress (GINA, 2024).

Examine How Recording and Tracking Respiratory Functions Helps Individuals with Asthma to Monitor and Safely Manage Their Condition

Monitoring Respiratory Function

An essential component of managing asthma is keeping an eye on respiratory function. It assists people in identifying respiratory changes and when their condition is getting worse. Frequent monitoring can lower the likelihood of severe asthma attacks and enable timely medication adjustments (NICE, 2021).

Peak Flow Readings

The rate at which air may be ejected from the lungs is measured by peak expiratory flow (PEF), sometimes referred to as peak flow. An easy-to-use, portable tool for monitoring lung function at home is a peak flow meter. It's common advice for people with asthma to take daily measures of their peak flow and compare them to their own best reading. Even before symptoms manifest, a decrease in peak flow may be a sign that the airways are narrowing or becoming inflamed (GINA, 2024).

Asthma Action Plans

Healthcare practitioners advise creating individualised asthma action plans to help people safely manage their illness. These plans include instructions on how to take medications daily, peak flow goals, and what to do if symptoms get worse. Additionally, they describe when seeking emergency care is necessary. According to the British Thoracic Society (2019), adhering to an asthma action plan can enhance symptom control and lower the frequency of asthma flare-ups.

Benefits of Regular Monitoring

People are encouraged to take a more active role in managing their condition when respiratory function is routinely monitored and documented. It enables medical practitioners to evaluate the efficacy of treatment and spot any changes in lung function over time. People with asthma can better manage their disease, lower their risk of complications, and enhance their quality of life by identifying triggers and acting on symptoms early (NHS, 2024).

Evidence-Based Recommendations on Lifestyle Changes to Improve Asthma

Smoking and Vaping Cessation

Avoiding smoking and vaping is one of the best methods to improve asthma management. E-cigarette vapour and tobacco smoke irritate the airways and cause inflammation, which can exacerbate symptoms and increase the frequency of asthma attacks. It has been demonstrated that quitting smoking enhances lung function and lessens the requirement for medication. Evidence suggests smoking also reduces the effectiveness of inhaled corticosteroids, making asthma more difficult to control (NHS, 2024).

Avoiding Asthma Triggers

Asthma attacks can be avoided by using inhaled corticosteroids, sometimes known as steroid inhalers, which lower mucus and inflammation in the airways. Asbestos and coal dust exposure at work can aggravate respiratory issues and harm the lungs. Asthma management and airway inflammation can be improved by changing one's lifestyle, such as quitting smoking, avoiding vaping, and limiting exposure to irritants (NICE, 2024; NHS, 2024).

Physical Activity and Exercise

Frequent exercise can enhance lung function and cardiovascular fitness and is good for general health. Asthma shouldn't prevent you from exercising as long as your symptoms are under control. To lower the likelihood of asthma symptoms brought on by activity, people should warm up before working out and use their relief inhaler as directed. Exercises including swimming, cycling, and walking are typically advised (Asthma + Lung UK, 2024).

Vaccinations and Infection Prevention

Exacerbations of asthma are frequently caused by respiratory infections. The risk of infection can be decreased by receiving annual influenza shots and maintaining current routine vaccinations. Asthma flare-ups can also be reduced by practicing good hand hygiene and avoiding close contact with those who have respiratory conditions (NHS, 2024).

Medication Adherence and Regular Reviews

Maintaining effective asthma control requires taking prescribed drugs as directed. While reliever inhalers offer rapid symptom relief, preventer inhalers aid in lowering airway inflammation. Treatment strategies can be modified in accordance with each patient's needs through routine assessments with medical specialists. Quality of life can be enhanced, and difficulties can be avoided by adhering to an asthma action plan and going to regular asthma reviews (GINA, 2024).

Conclusion

Wheezing, coughing, tightness in the chest, and shortness of breath are all signs of asthma, a chronic respiratory disease that narrows and inflames the airways. Recognising how asthma affects regular breathing and gas exchange requires an understanding of the structure and operation of the respiratory system. To deliver oxygen to the body and expel carbon dioxide, the respiratory system depends on effective mechanical respiration and gas exchange.

Increased airway inflammation can result in oedema, excessive mucus production, and bronchoconstriction when exposed to irritants like smoking, vaping, air pollution, and respiratory illnesses. These alterations can cause asthma attacks and make breathing more challenging. By using peak flow measurements and symptom diaries to track respiratory function, people can detect deteriorating symptoms early and take the necessary precautions to avoid consequences.

References

Asthma and Lung UK (2024) Asthma, Symptoms and Treatment. London: Asthma and Lung UK.

British Thoracic Society (2019) British Guideline on the Management of Asthma

Global Initiative for Asthma (GINA) (2024) Global Strategy for Asthma Management and Prevention.

Hall, J.E. and Hall, M.E. (2021) Guyton and Hall Textbook of Medical Physiology.

Marieb, E.N. and Hoehn, K. (2023) Human Anatomy and Physiology.

McCance, K.L. and Huether, S.E. (2019) Pathophysiology, The Biologic Basis for Disease in Adults and Children.

National Institute for Health and Care Excellence (NICE) (2021) Asthma: Diagnosis, Monitoring and Chronic Asthma Management.

NHS (2024) Asthma.

Tortora, G.J. and Derrickson, B. (2021) Principles of Anatomy and Physiology.

World Health Organization (2024) Chronic Respiratory Diseases.

West, J.B. and Luks, A.M. (2021) West's Respiratory Physiology, Philadelphia: Wolters Kluwer.

Widmaier, E.P., Raff, H. and Strang, K.T. (2019) Vander's Human Physiology, The Mechanisms of Body Function.