

BMHP5023 Introduction to Physiology

Assignment Title;
Component 1-Written Assignment (case study Report)

Student Name; Duwage Varuni Perera

Student Number; 2407132

Tutors Name; Robert Nartowski

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CASE STUDY 2

Introduction;

This case study offers an overview of asthma, covering its causes and main risk factors. It explains the physiology of breathing and how the respiratory system works. The discussion includes how recording and tracking tools like peak flow readings assist in managing asthma safely and effectively. Additionally, it presents evidence-based lifestyle recommendations to improve asthma control, boost lung function, and promote overall health and well-being.

What is Asthma and risk factors

Asthma is a chronic disease that affects the airways in your lungs, and its severity can vary from person to person, ranging from mild to severe (Dr Colin Tidy, 2016). There are two main problems in asthma: swelling of airway linings with increased mucus in the airway (inflammation) and intermittent narrowing of the muscles around the airway. This leads to obstruction of the air flow particularly during exhalation. Fortunately, this can be controlled with medicine and by avoiding triggers. When the airways are inflamed and narrowed, they trigger coughing, wheezing, shortness of breath and a tight feeling in the chest. These symptoms can occur especially at night or early in the morning reflecting the lowest timings of blood steroid levels (Sockrider and Fussner, 2020). Around 5.4 million people in the UK get treated for asthma. Every year about 160000 more people is diagnosed. A portion of these is due to exposure at work known occupational asthma (Nice, 2024).

Asthma can be more likely to develop due to various reasons. (NICE, 2025). Genetics play a role, if others in your family have asthma or allergies, you could be at risk too. If someone in your family has asthma or allergies such as eczema or hay fever, you are more likely to develop asthma too. This suggests that asthma often runs in families due to the inheritance of shared genes. Additionally, when babies or young children get certain viral infections, like respiratory syncytial virus (RSV) or the common cold virus (rhinovirus), it can affect how their lungs develop and how well their immune system works. This may increase their chances of developing asthma later. Also, environmental factors and allergens play a major role in developing and worsening asthma. Indoor allergens like dust mites, pet dander, cockroaches, and mould can cause airway inflammation and asthma symptoms, especially in sensitive people. Outdoor allergens, such as pollen and grasses, combined with air pollution, can further irritate the lungs, and increase the risk of asthma attacks (National Heart, Lung, and Blood Institute, 2024). People with obesity have a greater chance of experiencing asthma symptoms. Boys have asthma more frequently than girls when they are young, but in adulthood, women have higher rates of asthma (Chowdhury et al., 2021).

Structure of the respiratory system

This includes;

Nose and mouth – where air enters the body

Throat (pharynx) – a passage for air

Voice box (larynx) – helps with sound and lets air pass through

Windpipe (trachea) – a tube that carries air to the lungs

Bronchi – two large tubes that lead from the trachea into each lung

Bronchioles – smaller branches inside the lung

Alveoli - Tiny air sacs at the end of bronchioles

Lungs- Two spongy organs (right lung has 3 lobes, left lung has 2)

Diaphragm

The respiratory system helps us breathe by moving air in and out of the lungs. It brings oxygen into our lungs and removes carbon dioxide. Air enters through the nose or mouth and travels down the throat and voice box. Then, it goes down the windpipe, which carries air into the lungs. The windpipe splits into two tubes called bronchi, with one going to each lung. Inside the lungs, the bronchi divide into smaller tubes called bronchioles. At the end of these tubes are tiny air sacs called alveoli. Here, oxygen enters the blood, and carbon dioxide is removed. The lungs are protected by the rib cage. A large muscle called the diaphragm, located under the lungs, helps move air in and out as we breathe.

Process of Mechanical Respiration

Mechanical respiration is an essential process that facilitates the movement of air in and out of the lungs. It has two main parts: inhalation and exhalation.

During inspiration, the diaphragm plays a crucial role by contracting and moving downward, while the intercostal muscles between the ribs lift the rib cage upward and outward. This coordinated action expands the chest cavity, increases thoracic volume and causes a low-pressure or vacuum effect, allowing air to be drawn into the lungs through the nose or mouth. During exhalation diaphragm relaxes and moves upward, and the chest wall draws downward, causing decreased volume with increased pressure in the thoracic cavity, allowing air to move out from the lungs.

This movement of air is called mechanical respiration or ventilation. It is different from cellular respiration, which is the process that uses oxygen to produce energy inside the cells.

The process of gas exchange in the lungs

Air enters the body through the mouth or nose and goes to the pharynx. It then passes through the larynx and into the trachea. In the lungs the trachea splits into smaller branches called bronchioles then end up forming small globular cavities called alveoli. Here oxygen moves from the air into the blood and carbon dioxide, a waste product, moves from the blood back into the lungs. This exchange happens in tiny sacs called alveoli, which are surrounded by small blood vessels known as capillaries. Oxygen moves through the walls of the alveoli into the capillaries, while carbon dioxide moves from the capillaries into the alveoli (Medline Plus, 2022). Oxygen binds to haemoglobin (a protein contained in red cells that carries oxygen) in red blood cells and is carried to the body. Carbon dioxide, a waste product of metabolism, is at a higher concentration in the blood. Then it is expelled from the body when you exhale. When we breathe, harmful irritants like smoke, dust, fumes, allergens and pollution can get into our lungs. These substances travel through the nose, trachea, bronchi and lungs. Breathing in irritants can make your airways swollen and red, which makes it harder to breathe. This swelling is your body's way of protecting itself. When this happens, your body produces extra mucus to help remove the irritants. However, too much mucus can clog the airways and make breathing even more difficult. Some irritants can also tighten the muscles around your airways. This tightening can worsen breathing problems, especially for those with asthma. Swollen airways and excess mucus can prevent oxygen from getting into your blood, leading to tiredness and shortness of breath. By understanding how these responses work, you can take steps to manage your breathing better. When the body detects these irritants, it recognises them as potential threats and takes proactive measures to protect itself. It releases histamines and sends immune cells, such as macrophages and neutrophils, to the lungs to fight off irritants.

How Peak Flow Monitoring Supports Safe Asthma Management

Peak flow monitoring is a method to assess lung function by measuring how quickly you can exhale using a small handheld device known as a peak flow meter. By measuring the speed at which you can exhale, your peak flow score can serve as an important indicator of whether your airways are narrowed (NHS, 2017). Peak flow monitoring gives clear, measurable results that help track how well a person's asthma is controlled. Because symptoms can sometimes be hard to judge, especially in children, regular peak flow readings provide reliable information.

This information can help you and your healthcare provider make informed decisions about your respiratory health. Your peak flow score, which is also referred to as peak expiratory flow (PEF), provides valuable insight into how effectively and efficiently you can expel air from your lungs. By using a peak flow meter, you can easily monitor your score, which is measured in litres per minute (l/min). Regularly tracking this score can help you better understand your lung function and manage your respiratory health more effectively.

Asthma symptoms can vary from day to day, so tracking your peak flow is a proactive step you can take to manage your condition effectively. By monitoring your peak flow, you can identify patterns, such as when your symptoms worsen—after exercise or during pollen season. This information empowers you to assess your asthma's progress, allowing you to make informed adjustments to your medication and follow your asthma action plan for optimal management. Most people with asthma have a plan from their doctor to help manage symptoms. Your peak flow readings are split into zones (Asthma & Lung UK, 2022).

- (80–100%): You are doing well
- (50–79%): need to be careful, asthma can get worse.
- Less than 50%- take immediate action or call 999.

Lifestyle and Asthma: Evidence-Based Approach

Lifestyle changes can help to manage asthma conditions, such as a healthy diet, regular physical activities, quitting smoking and maintaining a healthy weight (Nyenhuis, Dixon and Ma, 2018). Adding more fruits, vegetables and grains to your meals and cutting down saturated fat can help ease asthma symptoms (Alwarith et al., 2020). Eating a lot of processed and sugary foods can make asthma symptoms worse. Additionally, vitamin D deficiency can increase the risk of asthma exacerbations (Chen et al., 2021). To help manage asthma better, it is helpful to follow a Mediterranean-style diet and ensure you get enough vitamin D.

Regular physical activities help lungs work better and improve overall health. Some people do activities like yoga, breathing exercises or meditation to help them breathe easier. Research indicates that both children and adults with asthma who engage in regular exercise experience fewer symptoms and a better quality of life. To support asthma management, it is recommended to participate in moderate-intensity activities such as walking, swimming, or cycling for at least 150 minutes per week (Price and Simpson, 2023).

Being overweight or obese is associated with worse asthma outcomes. Weight loss can help improve lung function, reduce symptoms, and enhance overall quality of life. Even a small weight loss 5-10% of excess body weight can significantly improve asthma symptoms (Stoodley et al., 2019). To manage asthma, it is important to avoid things that can make it worse.

If you quit smoking and minimise exposure to second-hand smokers or vaping, improve asthma control (Perret et al., 2016). Avoid common asthma triggers such as dust, pollen, mould, strong odours, pet dander and other sources as much as possible. Avoiding these triggers helps prevent asthma attacks and improves lung health. It is important for both patients and family members to stop smoking and to keep indoor air as clean as possible by reducing exposure to allergens and irritants.

Stress can significantly influence asthma by affecting the body's immune and hormonal systems, which may increase inflammation and elevate airway sensitivity. Nighttime asthma symptoms can disturb sleep, leading to poor disease control and tiredness (AAFA, 2018). To manage these issues, people can use cognitive-behavioural therapy, mindfulness, and stress-reduction techniques. These approaches can improve emotional well-being, help with sticking to medication, and lead to better asthma management. Having good quality sleep is supported to manage asthma, and control anxiety and stress and reduce asthma symptoms

Conclusion

Asthma is not just a breathing problem; it can affect an individual's daily life. It can occur due to several factors such as allergens, smoke, and infections. By understanding how the respiratory system functions and the impact asthma has on the gas exchange process in the lungs, this will help us to manage the condition better. When asthma causes inflammation and narrowing of the airways, it can hinder oxygen intake and make breathing challenging. However, tools like peak flow meters play a crucial role in monitoring lung function. This allows individuals and healthcare providers to make informed decisions about treatment strategies. The good news is that several lifestyle changes can significantly enhance asthma management. By avoiding known triggers, quitting smoking, staying active, and following medication plans, individuals can reduce flare-ups and improve their overall quality of life.

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