

Asthma is a chronic inflammatory disorder biology essay



**ASSIGN
BUSTER**

Introduction

Asthma is a chronic inflammatory disorder of the bronchial tubes that causes constriction and inflammation of the airways. This results in narrowing of the airways. Airways' narrowing in asthma is caused by three major processes that act on bronchi. These are: inflammation, bronchospasm and hyperreactivity. As a result, symptoms of wheezing, coughing, and shortness of breath occur. (Womenfitness, 2004)

This essay will aim to discuss the pathophysiology, epidemiology, aetiology and the various causes of asthma. Furthermore, it will compare recent prevalence rates and patterns that have arisen in recent years.

It will also concentrate on the effects of asthma on children and exercise, and the long term effects this may have on lung function.

Finally, it will present the hygiene hypothesis that has drawn great attention and speculation over recent years.

C: UsersuserPicturesasthma2. jpg

Figure 1 adopted from [asthma. about. com/.../def_hyperresponsiveness. htm](http://asthma.about.com/.../def_hyperresponsiveness.htm)

Phathophysiology:

Asthma is known to be an inflammatory disease which is characterised by airway inflammation, airflow obstruction and bronchial hyperresponsivness. The mechanism of airway inflammation in asthma maybe acute, sub acute or chronic. Inflammation is the most important factor that causes narrowing of the bronchial tubes. It increases the thickness of the wall of the bronchial

<https://assignbuster.com/asthma-is-a-chronic-inflammatory-disorder-biology-essay/>

tubes and produces excess mucous that forms plugs and clogs the small airways resulting in a smaller passageway for air to flow through. In irregular air flow obstruction and bronchial airway reactivity, oedema and mucus secretion also contribute to further narrowing of the airways. Thus resulting in difficulty breathing. When asthmatic patients are exposed to triggers such as allergens, irritant and infections, the inflamed or constricted airways becomes more sensitive or reactive to those triggers leading to increase narrowing and inflammation of the airways. As a result an asthmatic person has to make a greater effort during expiration and inspiration. (Szeftel and Shiffman, 2009).

Asthma is characterized by an increased number of mast cells, eosinophils, macrophages, activated T lymphocytes, dendritic cells and neutrophils in the bronchial tissues. During an asthma attack, antigen presenting cells e. g. (macrophages or dendritic cells) in the airways capture and process the inhaled allergen to T-lymphocytes which in turn becomes activated. Once T-lymphocyte becomes activated it produces TH1 cells and TH2 cells both secreting cytokines respectively. TH1 release (INF, lymphotoxin, IL-2) . TH2 release (IL-3, IL-4, IL-9, IL-13, IL-15). TH2cells (CD4 T-lymphocytes) has an important role in allergic response. Allergens drives the cytokine pattern towards TH2cells which in turn promotes B cells to produce immunoglobulin E (IgE) and eosinophil recruitment . Then IgE binds to high affinity receptor for IgE, Fc-epsilon-R1 on the surface of mast cells and basophils. This leads to degranulation of the cells and the release of mediators such as histamine, leukotrienes and other enzymes. The production of histamine and

leukotrienes result in bronchial hyperresponsiveness and airway obstruction causing the symptoms of asthma. (Morris, 2009)

Types of asthma:

There are two main types of asthma:

Extrinsic or allergy asthma: This type is more common and is responsible for 90% of all cases. It develops in children and is associated with features of atopy such as rhinitis or eczema. (Szeftel and Shiffman, 2009)

Intrinsic asthma: This type is less common and presents for only 10% of all cases. It is more commonly found in women after the age of 30 and is typically not associated with allergies. (ibid 2009)

Epidemiology

5. 4 million people in UK are currently receiving treatment for asthma.

1. 1 million children in UK are currently receiving treatment for asthma.

There is a person with asthma in one in five households in the UK. (Asthma UK, 2008)

The incidence of asthma has increased dramatically over the past 20 years. This is not due to changes in our genetic makeup, however, due to environmental factors (allergens, infection, lifestyle and diet) that influence the development of asthma.

The prevalence of asthma in Wales is amongst the highest in the world. With 260,000 people currently living with the condition and the rate of

hospitalization for adults is 28%, it exceeds all other regions in the UK.

(Asthma UK, 2009)

Mortality and morbidity

Asthma affects 5-10% of the population in United States or an estimated 22 million persons, including 6 million children. Asthma is common in industrial countries such as Canada, England, Australia, Germany and New Zealand.

The prevalence rate of severe asthma in those countries ranges from 2-10% and is estimated to affect 300million people world wide. There are about 5000 deaths per year in U. S. and about 500 deaths per year in Canada.

(Kelly, 2009)

C: UsersuserPicturesasthm prevalence. gif

Figure3: shows the high percentage of the population affected with asthma was reported in USA, Canada, UK, Australia and NewZeland (> 10%). The lowest prevalence were reported in China and India (<5%). adopted fromnews. bbc. co. uk/2/hi/health/3492731. stm

Asthma in children:

Asthma is the most common chronic disorder in childhood. It is a leading cause of school absences and hospital stay. In UK, over 1. 1 million children have asthma. Children who develop asthma in younger age are more likely to grow out of it when they get older. The bronchi of children with asthma are narrower than those of adults. Therefore, it becomes more sensitive and irritated to triggers such as, house dust mites, animal fur, pollen, tobacco smoke, cold air and chest infections. The severity of asthma differs from

child to child depending on the severity of the disease. The exact cause of asthma in children is still not fully understood. But it is suggested that it might be due to combination of both genetic and environmental factors. (Asthma UK, 2009).

Symptoms of children with mild cases of asthma include:

Coughing

Wheezing

Shortness of breath

Tightening in the chest

In severe cases, symptoms may be:

Difficulty in talking.

Skin is pulled in around the ribs and neck when breathing.

Bluish colour to the lips, fingernails, or face (due to hypoxia)

Wider nostrils.

Rapid heart rate.

Severe drowsiness or confusion.

What causes asthma?

Asthma is a complex condition for which its causes are still not well known.

Heritable and environmental factors may contribute to its development.

<https://assignbuster.com/asthma-is-a-chronic-inflammatory-disorder-biology-essay/>

There are some factors (host factor) that predispose to asthma. This includes:

Genetic:

There are number of genes that are associated with allergy. These include, interleukin 4 (IL-4), IL-5, granulocyte-macrophage, colony stimulating factor, interferon- gamma, tumor necrosis factor(TNF), IL-9, the promoter regions for IL-4 and IL-10, the affinity receptor for IgE, bronchial hyperresponsiveness (BHR) and B-adrenergic receptor. Chromosomes 5 and 11 have gathered the most attention to date. Chromosome 5 is important because the genes that are associated with allergy are located on it . These include, IL-4, IL-5, IL-3 and IL-13. Studies have linked this area to bronchial hyperresponsiveness to histamine. In the Studies of Cookson et al have shown that chromosome 11 is also important as the gene that is responsible for atopy which is (high-affinity IgE receptor) is located on it. (Gershwin and Albertson, 2001).

Gender:

Asthma tends to affect more male children less than 10 years old, however, by the age 21yr, females are more affected. Although asthma is not an X-linked disease, genetic factors have been found to locate to the pseudoautosomal portion of the XY chromosome. (Gershwin and Albertson, 2001).

Various factors can contribute to the pathogenesis of asthma and may be classified into two groups:

Allergens (specific) and these include:

Dust mites:

These are tiny-spider like creatures that can eat the skin particles human shed. They live in the dust that builds up around the house, in carpets, clothes, beddings, soft furnishing and soft toys. Many people with asthma are sensitive to house-dust mites particles and droppings which contain substances that cause inflammation of the airways. <http://www.womenfitness.net/wfimgank4/dustmite.jpg>

There are several recommendations to follow to reduce the presence of house dust mites:

Adapted from <http://www.womenfitness.net/asthma.htm> adapted from:- Use complete barrier covering systems for the mattress, pillows and duvet.

Replace all carpets with tiles.

Use high efficiency filter vacuum cleaners.

Wash the beddings in hot water weekly (to kill house dust mites).

Place the soft toys in a bag and put it in freezer for at least 6 hours every one to two weeks. (to kill the house-dust mites).

Use anti-house dust mites chemicals to clean soft furnishing.

Use dehumidifier to dry the air as it will prevent the survival of house dust-mites. (Womenfitness, 2004)

Pets:

Adapted from:- <http://www.womenfitness.net/asthma.htm> Many pets (cats, dogs, gerbils, rabbits, mice, birds and other furry animal) have been shown to trigger airway inflammation in allergic people. Allergens produced by animals and cause allergic reactions in some people are found in animals' dander, saliva, fur, and urine. The severity of allergic reactions to cats is greater than reactions to any other domestic pets. If asthmatic people are triggered by furry or feathery animals, the most effective way to control asthma is to get rid of pets from home. On the other hand, the less effective way is: <http://www.womenfitness.net/wfimgank4/pets.jpg>

Find a new home for pets or if not keep them out of living and bedroom.

Bathing cats and dogs twice a week may help.

Use high efficiency vacuum cleaner. (Womenfitness, 2004)

Pollen:

Pollen is a powder like substance produced by flowers and known to trigger asthma symptoms in some people. There are different types of pollen that can be found on certain trees, grasses and weeds which can be spread by wind. They differ in pattern according to their geographical areas. This is why different people are sensitive to different types of pollens.

To avoid asthma symptoms during pollen season it is advisable to:

<https://assignbuster.com/asthma-is-a-chronic-inflammatory-disorder-biology-essay/>

Stay in-door during peak time (midday and afternoon).

Keep home and car windows closed to lower exposure to pollen.

Molds:

Molds are types of fungus that release spores in the air which can trigger asthma symptoms in some people. They are found in any moisture place, wet piles of leaves in the fall and forest area, in bathroom, kitchen and piles of damp clothes. To avoid this trigger:

Make sure that house is well ventilated.

Make sure that damp and mould in home is treated quickly.

Avoid areas such as garden or compost that may contain mould spores.

(Womenfitness, 2004)

Food and food additives:

When the body's immune system reacts abnormally to a harmless substance such as food an allergic reaction occurs. Symptoms of food allergy can vary widely and flares up asthma attack. These symptoms include swelling and tingling in mouth, diarrhoea and vomiting in gut, rash and swelling of face in skin, or wheeze and shortness of breath in chest.

Foods that can provoke asthma attack by causing an allergic reaction include peanuts, sesame, fish, shellfish, diary products and eggs.

Foods containing additives such as dye tartrazine (E102) and preservative such as benzoic acid (E210) can trigger asthma.

Some foods and wine contain histamine or certain chemicals that can trigger asthma.

Sodium metabisulphite (E220-227) may also trigger asthma but not via an allergic reaction. (Asthma UK, 2009)

Studies have shown that changes in diet especially fast food, westernized diet has contributed with the increase incidence of asthma. Diet habits had change rapidly parallel with the changes in people lifestyle. People who eat less fruits or vegetables are more susceptible to asthma attack. Thus, these fruits and vegetables contain vitamins such as (C, E, carotenoids and flavonoids) which are known to be antioxidant and have anti-inflammatory effects. On the other hand, there is conflicting studies about the effect of omega-3 polyunsaturated fatty acids in asthma.

Vitamin D deficiency may increase the incidence of asthma as Litonjua and Weiss hypothesis. In fact, people in Westernized countries spend more time indoor; so not exposed directly to sunlight which is the major source of Vitamin D. Furthermore, vitamin D receptors shown to have a greater role in the pathogenesis of asthma as have been identified in various immune cells. (Kim et al, 2009).

Overall, researches and hypothesis couldn't approve the direct relationship between specific nutrients or food types and the prevalence of asthma. (Kim et al, 2009)

Occupational asthma:

Occupational asthma is due to exposure to specific substances at work.

Often, these materials are specific to certain professions. For example, some nurses develop occupational asthma in response to prolonged exposure to latex, and some workers in the industry of food processing to develop occupational asthma in response to prolonged exposure to flour. (NHS, 2007)

Environmental factors:**Infection:**

It is well recognized; especially in children in their early life who suffer from frequent respiratory infections (cold) are at high risk of developing asthma later in childhood. The most significant viruses that are associated with asthma include respiratory syncytial virus (RSV), rhinoviruses and parainfluenza. In asthmatic people, respiratory viral infections attract several inflammatory cells, change the expression of the receptor on airway smooth muscle and adjust neuroimmune mechanisms which lead to exacerbation of disease. (Van Rigit et al, 2005).

Smoking:

Smoking causes irritating substances to settle in the moist lining of the airways of the lungs which in turn causes an asthma flare-up. Exposure to environmental tobacco smoke (ETS) is a risk factor for asthma attacks in children (AAPCEH 1997). Children who live with parents who smoke are more likely to develop asthma attack and more severe symptoms. Children are at greater risk to develop sinusitis, otitis media and bronchiolitis when exposure to (ETS) (IOM 2000; Tager et al. 1993). (ATSDR, 2007)

Tobacco smoke damages the tiny hair called (cilia) which lays the respiratory system. These cilia are responsible to keep dust and mucous out of the airways and lungs.

Tobacco smoke causes more mucus production, clogging of the inflamed airways making it difficult to breathe.

Tobacco smoke also leads to other lung diseases such as cancer and emphysema.

Air pollution:

Air pollution may be responsible for triggering or causing asthma. There are two main types of air pollution derived from the burning of fossil fuels such as oil and coal.

Particulates and sulfur dioxide (SO₂):

Asthmatics are more sensitive to (SO₂) than non- asthmatics as its inhalation causes bronchoconstriction and wheeziness.

Photochemical smog:

There are several pollutants that are derived from car exhausts and are related to respiratory disease and these include nitrogen oxide, hydrocarbons, heavy metals and ozone.

NO₂:

Are produced in high temperature incineration conditions such as are found in petrol and diesel engine. Exposure to NO₂ causes bronchoconstriction in some people.

OZONE:

It is a secondary product of car exhaust formed by nitrogen oxide in the presence of hydrocarbons and sunlight. Ozone concentrations in air can cause reduced lung function, airway inflammation and increased bronchial hyperresponsiveness. It also increases the risk of atopic diseases. (ATSDR, 2007)

Exercise- induced asthma (EIA):

Exercise-induced asthma (EIA) also known as exercise-induced bronchospasm (EIB) is a condition in which exercise or vital physical activity triggers people with asthma. The mechanism responsible for EIA is unknown. It affects up to 80% of all asthmatics. This condition may be mediated by water or heat loss from the airway or combination of both. The abnormal heat and water loss in the bronchial tree result in bronchoconstriction occurring within minutes after completing exercise. (Kelly, 2009).

Factors contribute to exercise-induced bronchospasm (in both people with asthma and athletes:

Exposure to cold or dry air

Environmental pollutants (e. g sulfur, ozone)

Level of bronchial hyperreactivity

<https://assignbuster.com/asthma-is-a-chronic-inflammatory-disorder-biology-essay/>

Chronicity of asthma and symptomatic control

Duration and strength of exercise

Allergen exposure in atopic individuals

Coexisting respiratory infection

To avoid getting asthma attack during exercise:

Consult doctor regularly about taking medication for asthma before exercise.

Warm up for about 6-10 minutes before exercise by stretching or walking.

Do not work or play hard when the air pollution or pollens level are high.

Drug -induce asthma or (Aspirin-sensitive asthma (ASA)):

Chronic severe asthmatics are intolerant to aspirin. Ingestion of aspirin in these people causes bronchospasm, rhinoconjunctivitis and in severe cases it may lead to death. Aspirin is often associated with nasal polyposis and high eosinophils count in peripheral blood. The cause of ASA is not known, however it is thought to be due to abnormality in arachidonic acid metabolism.

Hygiene hypothesis:

The hygiene hypothesis proposes that the increase incidence of allergy and atopic diseases in Westernized countries is associated with decrease infections in childhood; increase the usage of antibiotics and changes in the endogenous intestinal microflora. Nowadays many children are not exposed to the same environmental triggers as did children in the past. Smaller

family size, children growing up in a cleaner environment and away from direct exposure to animals these all affects the maturing of immune system. The immune system has two types of lymphocytes. They are Th1 and Th2 cells. Th1 cells respond primarily to bacteria and viruses, while Th2 cells respond to parasites. Usually Th1 and Th2 cells balance each other for proper immune system function. But when children's immune system is not challenged by enough virus or bacteria, Th1 system could be underdeveloped or overdeveloped Th2 system which leads to increase allergic reactions and allergic disease. Th2 cells produces cytokines such as interleukin (IL-4, IL-5, IL-9, and IL-13) which has a critical role in of the initiation, maintenance, and amplification of human allergic inflammation. Important elements for hypothesis include helminth infection, exposure to endotoxin, exposure to pets, and growing up in a farm. (Romagnani, 2004)

The immunotherapy presented to us by nature has generally reduced, which can be attributed to the increase in asthma, allergies and autoimmune diseases. Furthermore, it has been recorded that urban areas have a higher rate of asthma sufferers and allergy complaints compared to the rural areas. (J Allergy Clin Immunol 2003; 111: 471-8)

The hygiene hypothesis may still have its many critics and it remains to be a topic of debate amongst researchers and healthcare workers. Nevertheless, this hypothesis allows us to greater understand the impact the environment has on our body's immune response.

Conclusion:

In conclusion the incidence of asthma has generally increased in the past century. As a result creating a larger population of patients. It is therefore important to realise the impact asthma may have in one's life. As seen earlier exercise induced asthma causes a large strain on those who attempt to complete physical activities. Perhaps more importantly is asthma in children and the burden it causes. It has been estimated that around 59, 000 children in Wales alone suffer from a degree of disability due to asthma (asthma UK, 2009). This helps put into perspective the huge economic and social impact asthma has on a society.

While immune disorders such as asthma, diabetes, and Multiple sclerosis continue to rise, the incidence of infectious diseases such as Hepatitis A and TB has decreased dramatically. This demonstrates the effects of improved healthcare provisions in the last century. Infectious diseases have been decreased by the use of antibiotics and vaccinations and most importantly awareness. On other hand the pollution and the life style in the development countries is consider a major factor associated with asthma.

Indeed the treatment options for asthma do exist; however, they do not provide the preventative effect that vaccinations have on infectious diseases. Recent research in gene therapy may provide a clear link between asthma and genetic factors, allowing us to tackle this debilitating disease.