

Biology of asthma and allergic disease



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I. ABSTRACT

The increasing prevalence of asthma and allergic diseases had inspired various researchers to conduct studies that will help understand the main causes, and solutions to the identified problem. This paper is important in creating a wider and deeper awareness and knowledge of asthma and allergic diseases. The study of the Biology of Asthma and Allergic Diseases intends to show the relationship between the increased prevalence of asthma and allergic diseases, and the hygiene hypothesis. The hygiene hypothesis claims that increasing exposure to dirt helps in creating an immune system that helps lower the incidence of asthma and allergic diseases. In this regard, gathering various studies, evaluating and creating lists of valuable evidences, and intelligently presenting them in this paper will help the public in many ways. First, the readers of this paper will have a better understanding of the biology of asthma and allergic diseases and to adopt possible solutions; second, this paper will pose a challenge to researchers, interested on this topic, to conduct further research studies; and third, various institutions studying this phenomenon may utilize this research to further support their claims.

II. INTRODUCTION

Asthma and allergic disease pose an increasing threat to humans. According to asthma statistics, there are an estimated 300 million people around the world who suffers from asthma, and 250, 000 deaths have been attributed to the disease annually (www.aaaai.org). In the United States, there are an estimated 34. 1 million Americans during their lifetime, who have been

diagnosed with the asthma disease (www.aaaai.org). What is more disturbing is the fact that, about 70% of people with asthma have allergies as well. The American Academy of Allergy Asthma & Immunology estimated that by the year 2025, over 100 million people will have asthma. In a survey conducted in the homes of Americans, it was found out that approximately one quarter had dust mites allergens in their bed, which is considered high enough level to trigger asthma. Statistics also showed that in 2007, 29% of children who had an allergy to food also had asthma. In fact, asthma was ranked as the third reason for the hospitalization among children under 15 years old (www.aaaai.org).

This paper titled Biology of Asthma and Allergic Disease: Hygiene hypothesis explains the biological basis of asthma and allergic diseases and the hygiene hypothesis as its focus area of research. The researcher will also focus on providing a deeper understanding of asthma and allergic disease, in terms of the disease's form, structure, function, growth and development, and behavior. Current researches on the hygiene hypothesis will be presented including the study's aim, methods and results. Moreover, this research paper will explain the value and application of the related research findings to the public health. Likewise, examples will be provided to give the readers with an understanding of how the presented information can be used in improving the public health policy, programs, and practice.

III. RESEARCH

The increase cases of asthma and allergic disease around the world have led to various researches and studies of its causes. The International Study of

Asthma and Allergy in Children in 2003, revealed that countries such as Australia, New Zealand and the United Kingdom have the highest prevalence of asthma (Holgate, 2004). The percentage rate of children with asthma in these countries was recorded at 20%, way higher than the recorded asthma patients in Central Africa, Central and Eastern Europe and China, which was less than 5% (Holgate, 2004). The report was confirmed when the European Community Respiratory Health Survey gathered almost similar results on difference of the prevalence on adult asthma and bronchial hyperresponsiveness in intercountry samples (Holgate, 2004). Although the suspected cause of the increased asthma may be genetic, a critical role of the environmental factors in the increased prevalence of asthma and other allergic disease is almost certain (Jarvis & Burney, 2000).

Allergy is described as comprises of a group of syndromes that includes asthma, atopic dermatitis, and hay fever, and tends to occur in familial clusters (Anderson & Morrison, 1998). The diseases such as asthma, atopic dermatitis, and hay fever have been classically associated with allergy as characterized by the sick person's immediate hypersensitivity reactions to intradermal allergens, increased serum IgE, and increased bronchial reactivity to specific or non-specific inhaled allergens (Anderson & Morrison, 1998). However, it was found that in contrast, some patients with asthma are seen without allergic disease (Anderson & Morrison, 1998). The explanation to this according to Anderson & Morrison (1998), is that the molecular biology of atopic asthma as illustrative of the advances in the basic science of allergy.

Asthma is defined as a syndrome characterised by diffuse narrowing of the bronchi that is relieved either spontaneously or after appropriate treatment with bronchodilators or anti-inflammatory drugs (Anderson & Morrison, 1998). Asthma can be seen in various forms such as paroxysms of cough, wheeze, and dyspnoea occurring periodically over time with complete or near complete symptom free periods, to persistent chronic asthma with frequent symptoms and the need for continuing treatment to maintain control of symptoms, and asthma that is resistant to steroids and is characterized by an incomplete reversibility of airflow obstruction despite treatment with bronchodilators and corticosteroids in high doses (Anderson & Morrison, 1998). The most common asthma is known as allergic asthma or extrinsic asthma (Cohen). Allergic asthma occurs when there is an excessive substance in the body known as the IgE, which reacts against the common things in the person's surroundings. Examples of these things are molds, dogs, grasses, trees, ragweeds, cats and many more; they are also commonly called, allergens (Cohen). Asthma has different clinical variants which are categorized as either atopic (extrinsic) and non-atopic (intrinsic or cryptogenic). Atopic or extrinsic asthma is the type of asthma that has a definitive cause and which is linked to the hygienic hypothesis, while in the non-atopic (intrinsic or cryptogenic), the cause is difficult to identify (Murphy, 2007).

The body's immune system is responsible in fighting infections that are caused by bacteria, virus, or parasite but it also recognizes foreign substance as allergens (ScienceDaily, Sep. 9, 2007). The general reaction of the immune system when it considers a substance as a threat is to activate B

lymphocytes (macrophages) that produce antibody that attacks it. The immunoglobulin E or the IgE which was produced by the antibody, cytokine, attaches to the mast cells and produce massive histamine which cause the mast cell to burst. The inflammation and symptoms of allergy occurs afterwards ([www. hygienehypothesis. com](http://www.hygienehypothesis.com)). The pathogenesis of asthma was described and explained in the book of Anna Murphy, *Asthma in Focus*, (2007). According to Murphy (2007), asthma disease is first received by various inflammatory cells such as the mast cells, T lymphocytes, macrophages and epithelial cells, and eosinophils. These inflammatory cells act as the principal recipient of the bacteria and are responsible for the production of various important inflammatory mediators. The mast cell is known as the producer of cytokines, which are important in the coordination and persistence of the inflammatory process in the chronic inflammation of the airways. T lymphocytes are the ones that cause the inflammatory response in the allergic asthma cases. The macrophages are called scavengers of the airways and are responsible for the digestion of the bacteria and other foreign objects. Eosinophils are the ones responsible for the hyperresponsiveness reaction of the asthma (Murphy, 2007).

The risks factors that contribute to the increase of the prevalence of asthma are categorized by Murphy (2007) as preventable and non-preventable.

Murphy (2007) listed the preventable risks factors as area of residence, allergen exposure, atmospheric pollution, environmental tobacco exposure, diet, physical activity and fitness and immunization, while the non-preventable risks factors are sex, family history, season of birth, birth weight, family size and position, infection and low income (Murphy, 2007). It

is surprising however, that the common cause of asthma are those that are under the preventable factors list. Charles Harrison Blackley (1873), in his *Experimental Researches on the Cause and Nature of Catarrhus Aestivus* made it clear that there is a direct relation between pollen exposure and hay asthma and hayfever. Blackley, installed a pollen counter on his roof, in Manchester and observed how the symptoms of rhinitis and asthmas occur as the pollen count collected increase over the twenty four hour period in the months of June and July. After gathering enough evidences to prove his inference, he stated I am, as I have intimated, quite aware that other agents may yet be found to produce symptoms not unlike those of hayfever. Amidst the great number of bodies there are with functions similar to those of pollen, it would not be surprising if we should find some that have a similar kind of action; and it is not improbable that among these, we may find the exciting causes of some diseases which are far more formidable than hayfever (Blackley, 1873).

Although many believed that the prevalence of acquiring allergic asthma can be prevented through eliminating exposure to allergens, hence, the growing number of allergic asthma worldwide proved that it is still not generally effective. In fact, despite various studies and researches, the main cause of the asthma and allergic disease is still difficult to understand. The exposure of people to a higher level of allergens in their dwelling places, due to the changing lifestyle, such as the use of air conditioning, soft furnishings, may have contributed to the rising trends. However, in the study conducted among farm children, comparing them with the general population showed that children who are exposed to livestock have a 50-75% reduced

prevalence of allergic diseases and asthma (Holgate, 2004). Considering this result, one can say that a person's hypersensitivity to allergens may have been caused by his less or no exposure to them, which is the main claim of the hygienic hypothesis.

The hygienic hypothesis which was developed by David Strachan in 1989 suggests that the increased number of allergic diseases such as asthma or allergies may be linked to the person's reduced exposure to germs (Peterson, 2010). Strachan believed that the absence of repeat exposure, and under-stimulation in developing immune system will result to over stimulation of harmful substances that results to the development of allergies (Peterson, 2010). The hygiene hypothesis further suggests that if a person is exposed to the infections or allergens early in life, he may develop immunity to them, leading to reduced risk of acquiring asthma and allergic diseases (Holgate, 2004). Marc McMorris, M. D., a pediatric allergist at the University of Michigan Health System said, We've developed a cleaner lifestyle, and our bodies no longer need to fight germs as much as they did in the past. As a result, the immune system has shifted away from fighting infection to developing more allergic tendencies (ScienceDaily, Sep. 9, 2007).

The international Study of Asthma and Allergies in Childhood (ISAAC), a global collaborative research, made a comparison of the asthma symptoms on various countries and found out a 15-fold variation and epidemiologic data, which are consistent with the hygiene hypothesis (Yeatts, et al, 2006). The study also showed that English-speaking countries tend to have a higher incidence of asthma and allergic diseases. The prevalence of asthma was

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also lower in East Germany than in West Germany. Other supporting evidence to the hygiene hypothesis was the higher occurrence of skin allergies and skin diseases on children born and raised from affluent families and those who are first-born (Strachan 1989; Wickens et al. 1999; Yeatts, et al. 2006). The children who have been exposed to infections in their local daycare showed a lower incidence of asthma (Yeatts, et al, 2006, Ball et al. 2000). A higher level of endotoxin; a gram-negative bacteria, which is responsible for stimulating the immune system of children to develop Th1 was also recorded where livestock animals live (Yeatts, et al, 2006).

One of the challenges of the hygiene hypothesis is, it assumes that once the child's immune system is fully developed, it can never be changed. This assumption was challenged in the study of Douwes, et al. (2004). Douwes, et al. (2004) believed that the human immune system is not fixed until he reached one year old; that is deviating the immune system may still occur throughout the man's lifetime. Hence, a bigger challenge is to identify the contributory factors that will lead to the adherence of the hygiene hypothesis in combating asthma and allergic diseases. Moreover, learning the strategies that will alter the human environment and reduce the risks of asthma and Th2 sensitization are also being sought.

IV. Application of Research Findings To Public Health

Studying the selected topic provides its readers with the valuable information and helpful guides in managing asthma and allergic diseases. Likewise, a deeper understanding of asthma and allergic diseases will help in its prevention and possibly of its cure. For instance, Wohlleben & Erb (2006)

conducted a study on knowing the immune stimulatory strategies for the prevention and treatment of asthma, found out that stimulating the immune system leads to Th1 and Tr responses. They believed that the increased cause of the asthma incidence was due to the decline of the infectious diseases that induce the inflammatory cell responses. In their study, Wohbellen & Erb (2006) made use of vaccination to animals of live or killed bacteria or its components to see how the Th1 respond. After the experiment, they concluded that the animals can be protected from developing asthma through stimulating the immune system that leads to Th1 or Tr responses. The results of this study are being discussed for the possible experimentation on human being to possible end the problem on asthma and allergic diseases.

V. CONCLUSION

The increasing worldwide prevalence of these diseases is very alarming because it does not only threaten life, but also the economy and society. The high costs of hospitalization related to these diseases and its related impacts have required various governments and health institutions to make deeper and wider study and research of its causes and solutions. The hygiene hypothesis can be a good start on understanding the disease as it claims that dirt exposure is still important in creating immunity to it. Thus, the study suggests that the exposure of humans to harmful elements in his environment can only be limited but not totally eliminated. For instance, in the continuous efforts of humans to create a germ-free environment, he may have become unaware that he is also weakening his immune system that may lead to life-long diseases such as asthma and allergies. In all aspects of <https://assignbuster.com/biology-of-asthma-and-allergic-disease/>

life, anything that is more than enough can be harmful. Various experiments have been made to increase the Th1 responses of human to stimulate the immune system. The challenge however, is on creating positive factors that will help confirm the hygiene hypothesis to make it fully acceptable as basis for eliminating the diseases. Thus, with all the current knowledge and understanding of this topic, the increased prevalence of asthma and allergic diseases until halted, will continue to become an important field of research.

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