THE OPHTHALMOLOGY MANAGEMENT OF PRIMARY SCHOOL CHILDREN AMONG CHINESE ETHNIC GROUP IN PENANG, MALAYSIA

By

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ABSTRAK

Selama ini, kesilapan pembiasan mata ialah satu isu sosial di semua negara terutama dalam masyarakat Cina. Dalam lingkungan Asia, kelaziman kesilapan pembiasan direkodkan tertinggi dalam populasi Cina bandar seperti Hong Kong, Taiwan, Singapura, China Selatan dan Malaysia. Kerosakan visual disebabkan oleh ralat biasan yang tidak dibetulkan semakin dikenali di seluruh dunia sebagai satu penyebab penting kecacatan visual yang boleh dielaki. Kesilapan pembiasan mata dikenali sebagai kerosakan visual paling senang dirawat dan paling kos eficien dalam penjagaan mata. Bagaimanapun , ini adalah lebih baik mengelakkan kesilapan pembiasan mata kerana orang yang ralat biasan perlu menanggung dengan bebanan fizikal dan beban kewangan cermin mata sepanjang hayat mereka. Kepercayaan kecekapan diri mencadangkan kanak-kanak sepatutnya mempunyai kesedaran untuk membetulkan kesilapan kepercayaan diri mereka, tabiat, meningkatkan amalan-amalan kawal selia sendiri mereka dan mengubah struktur sekeliling supaya mempunyai pemahaman yang lebih baik dalam kesilapan pembiasan mata. Walau bagaimanapun, kajian yang lalu untuk menentukan faktor-faktor yang berkaitan dengan kesilapan pembiasan mata di Malaysia untuk kanak-kanak Cina masih sangat kurang. Maka, kajian ini dijalankan untuk menentukan faktor-faktor yang mempunyai pengaruh terhadap kesilapan pembiasan mata antara kanak-kanak sekolah rendah Cina dengan menggunakan sampel 168 pelajar dari dua sekolah jenis kebangsaan rendah Cina di Pulau Pinang, Malaysia. Kajian ini mendapati tabiat makan dan ciri-ciri genetik tidak mempunyai pengaruh penting terhadap kesilapan pembiasan mata. Bagaimanapun, gaya hidup yang tidak sihat, pencapaian peribadi yang baik dan

pergantungan mesin telah didapati secara positif mengaruh kelaziman kesilapan pembiasan mata antara kanak kanak sekolah rendah Cina di Penang, Malaysia.

ABSTRACT

All the while, refractive error is a social issue in all countries especially in Chinese community. Within Asia, the prevalence of refractive error is recorded the highest in urban Chinese populations such as Hong Kong, Taiwan, Singapore, Southern China and Malaysia. Visual impairment because of uncorrected refractive error is increasingly being recognized worldwide as an avoidable visual disability. Refractive error is known as the easiest visual impairment to treat and the most cost efficient eye care interventions. However, it is better to prevent refractive error because refractive error people will have to endure with the physical encumbrance and the financial burden of spectacles throughout their lives. Self efficacy belief suggested that children should have awareness to correct their faulty self beliefs, habit, improve their self-regulatory practices and alter the surrounding structure in order to have better understanding in refractive error. Nevertheless, previous studies to found the risk factors which related to refractive error in Malaysia Chinese children population is still very less. Thus, this study is conducted to determine the risk factors which have influence to refractive error among Chinese primary children by using a sample of 168 students from two government Chinese primary school in Penang, Malaysia. This study found that eating habit and genetic traits do not have significant relationship to refractive error. However, unhealthy lifestyle, good personal achievement and machine dependence are found to positively associate with the prevalence of refractive error among Chinese primary school children in Penang, Malaysia.

Chapter 1 INTRODUCTION

1.1 Introduction

This chapter introduces the research outline of the study. It begins with expressing the background of the study, the problem statement with research objectives and followed by research questions. The significance of this study will highlight in end of this chapter and will give an overview of the next chapters in the thesis.

1.2 Background

World Health Organization has globally estimated that there are approximately 314 million people are live with vision impairment. Division from this number of visual impairment, there are 269 million people having low vision and 45 million are blind because of refractive error. The geographic distribution of visual impairment is not uniform and more than 90% of visual impairment people in the world are in found developing countries. (Susan Lewallen et al. 2009)

The Global Initiative for the Elimination of Avoidable Blindness (Vision 2020: The Right to Sight) has set a major challenge which requires a significant increase in the provision and uptake of eye care services around the world. The eye care service needs to be more widely available if the trend in visual impairment is increasing. One of the most significant barriers for the refractive error people to access eye care services is affordability. The shrinking economies of many countries in the world especially some poor countries are placing increasing pressure on health care budgets that are already severely over stretched. The budget for eye health services has been pushed further down

in the list of public health priorities after compete with the demands from life threatening diseases such as AIDS, malariaand tuberculosis. Obviously, this is due to refractive error was not a life threatening disease which can cause death. At the same time, the increasing cost of health care has forced many governments to restructure of their health delivery systems in their countries. (Martin Kyndt, 2001)

According to R. D. Thulasiral et al. (2003), the majority of refractive error people should have their sight restored by spectacles, but only a few of them have access to eye examinations and affordable for corrections. The balance of people with uncorrected refractive error in developing country will likely has deteriorated eye sight and become permanent visual impaired. It may cause blindness to the person if his refractive error continues unattended.

In order to correct refractive error, myopes (refractive error people) need to endure with the physical encumbrance and the financial burden of spectacles throughout their lives in order to restore visual acuity. The need for optical correction in school myopes has significantly affected the social activities of millions of children during their productive age.

Undeniable that refractive error is known as the largest percentage of overall vision problems in the world but it also classified as the easiest visual impairments to be corrected and the most cost-efficient eye care interventions. The cost of the elimination of blindness and permanent visual impaired due to uncorrected refractive error are estimated

at US$5 per person in need of spectacles. The cost of providing eye care to people who are visually impaired because of uncorrected refractive error by year 2020 would be estimated at $1.5 billion dollars. Hence, the challenges of correcting refractive error of millions of people around the world are to find innovative ways to provide access to eye exams, consistent supply and financing of spectacles. (Kammerle Schneider, 2004)

Dr. Vivek Trivedi et al. (2006) established that there were about 70% of refractive error people in India who have refractive error are benefit greatly from wearing spectacles to correct refractive error. Hence, it is important to develop effective strategies to eliminate this easily treated visual impairment. Children are significantly warranted urgent action to correct their visual error by providing adequate spectacles because this would enhance his/her school and social participation and psycho social development. As the defective vision is an obstacle to learning process and are prone to accident. Children may lose confidence and become inactive in their learning activities due to they have uncorrected refractive error. In addition, wearing of spectacles helps to prevent further deterioration of visual impairment and irreversible damage to retina. Information, education and communication regarding refractive error is important to the people in health service centre, teachers, parents and even children themselves because all of these parties play important roles in prevention and early detection of refractive errors. These groups of people shall be educated to have knowledge and awareness of early detection of refractive errors.

Apparently, uncorrected refractive error may turn school-going children become visual disability in the world today. Nanthan Congdon et al. (2008) showed that about 43% to 78% of 15-year-old children suffer from refractive error among secondary-school students in China. More surprisingly is that about 60% to 70% of refractive error children in Chile and China were uncorrected by spectacles while about 25% of Australia children who need spectacles also do not have them. This shows that there is many refractive error people are not getting correction for their visual impairment. Hence, it is better to prevent refractive error rather than seek for correction.

In fact, three major races in Malaysia such as Malays, Chinese and Indians have almost similar genetic make-up compared with Malays, Chinese and Indians in Singapore. However, Seang-Mei Saw et al. (2006) found out that the ethnicity-specific prevalence of myopia in Singapore Malays, Chinese and Indians are higher than that in Malaysian Malays, Chinese and Indians. Based on history, Chinese in Singapore and Malaysia were migrated from the same localities in South China and Indians in Singapore and Malaysia were migrated primarily from South India and Sri Lanka. Majority of the Chinese and the Indian families have lived for decade after migration and the Malays are native to Singapore and Malaysia. This shows that the environment may be a contributing factor that leads to higher myopia rates in Singapore. Ethnic composition in Malaysia population is estimated at 71.1% Malay, 16.3% Chinese, 8.7% Indian and 4.0% of other ethnicity. However, the prevalence of myopia in Malaysian Malays is 9.2%, Malaysian Chinese 30.9% and Malaysian Indians 12.5%. Hence, Malaysia Chinese is identified as the race that has the highest prevalence of refractive error.

In conclusion, the above phenomenon highlighted a troubling health issue about the prevalence of refractive error and urgent action warrants to correct this visual impairment. Nanthan Congdon et al. (2008) argued that positive attitudes and practices are required among the refractive error people or the prospective candidates of refractive error across all gender and educational levels so that during their consultation with eye care professional, they will have positive attitudes as well as allaying fear of wearing spectacle for visual correction is required. They should be educated on usefulness of wearing spectacles to correct refractive error, emphasizing positive attitudes and practices to prevent prevalence of refractive error and eliminating unfounded fear of spectacles during consultations from professional if having refractive error problem to avoid deterioration of refractive error.

1.3 Problem Statement

Malaysia Chinese is defined to have the highest prevalence of refractive error among all races in Malaysia. The ophthalmology management of Chinese primary school children in Malaysia has become a social issue due to the refractive error rate in this race is growing in Malaysia population especially in childhood. A study on the prevalence of refractive error and visual impairment in school-age children in Gombak District, a suburban area near Kuala Lumpur city, was carried out in 2005 and found that more than half of those with refractive error who needed corrective spectacles were without them. Refractive error in school-age children in urban Gombak District was mostly caused by myopia, with a particularly high prevalence among children of Chinese ethnicity. (Pik-Pin Goh et al., 2005)

Myopia is the most common type of refractive error among children. The costs of correction for myopia with spectacles, contact lens or laser medical treatment in optometry and ophthalmology centers have amounted to billions of dollars. Therefore, understanding the negative impacts of refractive error and underlying factors contribute to refractive error are important to reduce the prevalence of refractive errors in Malaysia. The prevalence of myopia in Malaysia is consisting of 9.2% Malaysian Malays, 30.9% Malaysian Chinese and 12.5% Malaysian Indians. Within Asia, the prevalence of myopia is recorded the highest in urban Chinese populations such as in Hong Kong, Taiwan, Singapore and Southern China while the lowest in non-Chinese rural populations such as Nepal and India. The possible risk factors inducing refractive error among Chinese children in urban area are significant for society awareness. The refractive error issue will become a future social illness if the prevalence of refractive error keeps increasing and not under control. Hence, it is crucial to identify the possible underlying factors which contribute to refractive error. By knowing the possible underlying factors, prevention or avoidance of these factors may reduce the prevalence of refractive error especially young age children. Hence, the community shall be given the information and education in prevention and early detection of refractory errors especially myopes themselves should even know more in details about how to take care of their eyes in prevent deterioration of their eye sight.

Thus this study is conducted to identify the positive risk factors which significant related to refractive error among Chinese children in Penang, Malaysia.

1.4 Research Objectives

Therefore, this study attempts to accomplish six main objectives as follow:

1. To determine whether there is relationship between eating habit and refractive error
2. To determine whether there is relationship between genetic traits and refractive error
3. To determine whether there is relationship between lifestyle and refractive error
4. To determine whether there is relationship between personal achievement and refractive error
5. To determine whether there is relationship between machine dependence and refractive error
6. To investigate whether gender and age moderate the relationship between possible risk factors and refractive error.

1.5 Research Questions

This study tries to answer the following research questions to achieve the above objectives:

1. What is the relationship between eating habit and refractive error?
2. What is the relationship between genetic traits and refractive error?
3. What is the relationship between lifestyle and refractive error?
4. What is the relationship between personal achievement and refractive error?
5. What is the relationship between machine dependence and refractive error?
6. Are gender and age moderating the relationships between the possible risk factors and refractive error?

1.6 Significance of the Study

This study is developed for community to understand possible risk factors which related to refractive error so that the increase of prevalence of refractive error may be controlled. This study's objective is to promote prevention of refractive error and avoidance of refractive error deterioration among children through self-awareness of negative impact in refractive error and adopting self-regulatory strategies. We discuss this study's theoretical framework based on the social cognitive theory- self-efficacy in health behaviors. Health behaviors dependent on one's level of perceived self-efficacy because self-efficacy are cognitions that determine whether health behavior change will be initiated. The children improved self-perceptions of refractive error, perceived benefits in the performance of self-efficacy and move forward to the action change. This study helps children benefit from educational interventions that promote self-awareness and self-efficacy of eye health care.

This study will make contributions to children, parents and community by providing useful information to reduce prevalence of refractive error. This study will determine the possible risk factors which related to refractive error in terms of environment aspect and non environment aspects. The study will help them to determine and avoid these possible risk factors which may induce refractive error. The community must understand that this information is important to alert and to make awareness among them because uncorrected refractive error has become the leading cause of visual disability among school-age children of European, South Asian and East Asian. Although refractive error can be corrected with suitable spectacles to improve the children's school

and social participation and psycho social development, it is better to prevent refractive error because myopes will need to endure with the physical encumbrance and the financial burden of spectacles throughout their lives.

1.7 Organization of the Remaining Chapters

This study is structured in five chapters. The first chapter provides an introduction as well as an overview of this study. The second chapter presents the review of literature that highlights the findings in previous research studies undertaken in relation to refractive error, theoretical framework and the hypotheses development. Chapter three will illustrate the data and variables in term of research design, unit of analysis, sample collection, measurement of variables, the method of data analysis and expected outcome. Chapter four analyzes the results of finding, focusing on statistical analysis, descriptive statistic, binary logistic analysis and discriminant analysis and comparison between both analyses. Lastly, chapter five will present the discussion on overall findings, implications of the study, limitation of the study, as well as suggestion for future research and conclusions.

Chapter 2 LITERATURE REVIEW

2.1 Introduction

This chapter will present the previous literature that has been undertaken. As such, this chapter will give an overview of literature on the prevalence of refractive error; the influence of eating habits, genetic trait, lifestyle, personal achievement and machine dependence to refractive error. The theoretical framework and the hypothesis development will be presented in the end of this chapter.

2.2 Social cognitive theory- self-efficacy in health behavior

Self-efficacy belief provides the foundation for human motivation, well-being and personal accomplishment. This is because people need to believe that their actions can produce healthy eyes as outcomes which they desire so that they have incentive to act or to persevere in facing any difficulties. From this theoretical perspective, human functioning is viewed as the product of a dynamic interplay of personal, behavioraland environmental influences.

Health behaviors such as diet habit, non-smoking, physical exercise, dieting, condom use, dental hygiene, seat belt use, or breast self-examination are, among others, dependent on one's level of perceived self-efficacy. Self-efficacy beliefs are cognitions that determine whether health behavior change will be initiated.(Beth T. Stalvey et al., 2003) People's awareness to correct their faulty self-beliefs and habit (personal factors), improve their self-regulatory practices (behavior)and alter the surrounding structures (environmental factors) in order to have a better understanding in refractive error and its

negative impacts. It is because human are viewed as self-organizing, proactive, self-reflecting and self-regulating rather than reactive organisms which shaped and shepherded by environmental forces. Firstly, myopes need to realize his personal eye care condition and understand the underlying factors which involved in causing refractive error. Then, myopes must decide upon actions taken to prevent or correct his refractive error as soon. (Frank Pajares, 1996*)*

2.3 Types of refractive error

There are basically three types of refractive errors that affecting children's eyes such as (1) Myopia (near-sighted) – this is a condition where the distance vision is blurred but the person still usually can see well for reading or other near sighted tasks. This occurs most often in school-age children, although occasionally younger children can be affected, (2) Hyperopia (far-sighted) – most children are normally far-sighted early in life and need no treatment for this because they can use their own focusing muscles to provide clear vision for both distant and near vision and (3) Astigmatism – caused by a difference in the surface curve of eye. Instead of being shaped like a perfect sphere, the eye is shaped with a greater curve in one axis. If a person has a significant astigmatism, fine details which seen may look blurred or distorted. (American Association for Pediatric Ophthalmology and Strabismus, 2010)

2.4 Treatment of refractive error

Eye is one of the most sensitive and complex organs in human body. It includes a transparent lens that helps to focus light on retina and send signal to human brain for

visual ability. Refractive error is an inaccuracy of focusing the light by eyes and a frequent reason for reduced visual acuity. Refractive error is disorder that results blurred image of the person but it is not an eye disease. A refractive error person needs external accessory to help rectify the error of light bend in his eye to restore visual acuity. The external accessory is to manipulate the light bend in eye to focus accurately on retina for obtaining clear and sharp image.

Wearing spectacles is an easy method to correct refractive errors by focusing the error of light on the retina and obtain clear image. It can also help to protect eyes from harmful light rays such as ultraviolet (UV) light rays. A special lens coating that screens out UV light is available in ophthalmology centers. Spectacles or goggles made of protective lens material (polycarbonate) should be used for sports or in all hazardous activities. All children and adults who have poor eye sights should wear protective polycarbonate lenses at all times to protect their eyes. (Kammerle Schneider, 2004)

In conclusion, significant visual impairment due to refractive error was found among school-age children living in a rural district of western India. Most of the refractive error can be easily corrected with spectacles and should be taken action when early detection because refractive error has detrimental impact on education and development in a child's life. Cost-effective strategies to eliminate this easily treatable cause of visual impairment are warranted. (Dr. Vivek Trivedi & Dr. Sandip Zalawadiya et al, 2006)

2.5 Prevalence of refractive error

Visual impairment because of uncorrected refractive error is being recognized globally as an avoidable visual disability. This recognition is evidenced by its inclusion in the priority areas of Vision 2020: The Right to Sight— a global initiative launched by a alliance of non-governmental organizations and World Health Organization (WHO). In addressing the widespread need for population-based data on childhood refractive error, the Refractive Error Study in Children (RESC) protocol was developed to assess the prevalence of visual impairment and refractive error in children among different ethnic origins and cultural settings. Eight RESC surveys were conducted in Nepal, China, Chile, India, South Africa and Malaysia between year 1998 and 2003. (Solange et al., 2008)

The aim of "Vision 2020 – the Right to Sight" is to eliminate needless blindness by the year 2020. Refractive error can be simply diagnosed, measured and corrected with spectacle and provision of spectacles is extremely cost-effective in reducing visual impairment. The lack of spectacle provision in eye care services in underserved communities has significant negative consequences in terms of lost educational and employment opportunities which impact quality of life and lost economy for individual, family and society.

Within Asia, the prevalence of myopia is the highest in urban Chinese populations such as Hong Kong, Taiwan, Singapore and Southern China and the lowest in non-Chinese rural populations such as Nepal and India. The differences in myopia rates may be attributed to variations in genetic susceptibility or environmental lifestyles. It has been

supposed that near work activity and competitive education system may be the primary environmental factors which related to myopia while the genetic susceptibility to myopia may be polygenic in nature. The inter-country ethnic-specific differences in myopia prevalence may be primarily environmental in nature. For example, the majority of children in Singapore attend pre-school (kindergarten or a child-care centre) and the syllabus may more structured and vigorous with a greater use of information technology. (Seang-Mei Saw et al., 2006)

Bei Lu et al. (2009) stated that uncorrected refractive error is the leading cause of visual disability among school-aged children of European, South Asian and East Asian descent. As a result, programs to improve children's access to spectacles have become increasingly popular and important. However, these are reports demonstrated that rates of spectacles wearing may be low among children, even those who have recently been provided free spectacles. Accuracy of the prescription in wearing spectacles has appeared to be an important problem in some of the countries. Bei Lu et al. (2009) believed that there is more significant in pharmacologic and refractive strategies to prevent or slow the prevalence of refractive error in children. Behavioral strategies often focused on reducing near work or visual activity with a high accommodative demand because near work has been reported as a factor which may increase the risk for myopia development in some other studies.

Nanthan Congdon et al. (2008) found out that visual disability in rural Chinese middle school population was common and highly correctable but frequently uncorrected.

However, due to a combination of no spectacles ownership and inaccurate prescriptions on refractive error, only slightly 50% of children whose visual impairment can be corrected have actually wearing spectacles to improve their visual acuity. Some schools need to have repeated examinations to accommodate children who had not brought their spectacles to school to remember bring their spectacles to school. However, a relatively high rate of spectacle wear among children with refractive error (74%) has been reported for urban China. A population-based study of school-aged children in Asia has generally reported a higher prevalence of myopia among urban groups as opposed to rural-dwellers. Among several surveyed populations, Aaron M Castanon Holguin et al (2006) observed that the rate of wearing spectacles to rectify visual impairment due to refractive error is low in urban China. Despite such low rates of compliance with spectacles, it is important to figure out the factors which contribute to refractive error so that people can live with good eye sight without spectacles. According to Aaron M Castanon Holguin et al (2006), the prevalence of refractive error is well known to increase with age.

The fact that a large number of children are without sight improving spectacles is particularly concerned in the discussion of recent studies that demonstrating significant improvement in self-reported visual function associated with spectacle wear among children with only moderate levels of myopia. The provision of spectacles is a non invasive and inexpensive intervention which potentially improves the visual function of a large number of school-aged children. However, the full impact of this intervention has not been achieved in many populations as they are not aware of the usefulness of spectacles in correcting their visual functions.

2.6 Eating Habit

Eating habit is identified to have some impact on children eye development in previous researches. Louise Katz (2009) studies show that myopic participant are reported significantly eat less fresh fruit, vegetablesand whole grains in their daily diet. In the studies of eating habits related to myopia, urbanization would be expected to create a multiplicity of changes in children's eating habits including diet e.g. food that are not as fresh due to access to refrigeration, non-locally grown food, processed, canned and frozen food. In current busy society, a lot of families do not have time to buy fresh food from market daily to prepare their meals. Hence, their meal ingredients are mostly relying on food that is not as fresh due to access to refrigeration, processed, cannedand frozen food. In addition, consumption of less fresh fruits and less whole grains food is also being discouraging eating habit that potentially lead to the person to have refractive error.

Besides, M. H. Edwards et al. (1996) found out that the children who became myopia tended to have generally lower food intake of protein, fat, cholesterol, vitamin B, vitamin C, phosphorus and iron than who are not myopes. The myopes are tends to have imbalance nutrition diet in their daily meal compared to the non-myopes. The nutrition of protein, fat, cholesterol, vitamin B, vitamin C, phosphorus and iron are important in maintaining eye health to prevent refractive error.

Dr. Semba claimed that severe, prolonged deficiency of vitamin A remains a leading cause of preventable mortality, morbidityand blindness in preschool children in developing countries. Vitamin A deficiency causes deterioration of the mucous-forming

cells of the eye resulting in conjunctiva necrosis, foamy gray spots consisting of hardened epithelial cells and scarring and softening of the cornea which cause irreversible blindness. The causes of vitamin A deficiency are simply inadequate vitamin A intake from foods and lack of access to dietary supplements containing vitamin A. Vitamin A can be understood to play an important role in personal eye health and prevent refractive error. (Richard D. Semba et al 2007)

Richard D. Semba et al. (2007) stated that the concentration of vitamin C in the corneal epithelium is the highest among all body tissue. The function of vitamin C is to protect proteins of the crystalline lens from oxidation, filters ultraviolet light and promotes wound healing in the cornea. Even though scurvy is accompanied by vascular abnormalities of the conjunctiva, dry eyes and hemorrhaging of the conjunctiva, orbit, anterior chamberand retina. Despite this oversight, ensuring adequate vitamin C intake may appear as a vital public health measure in the near future.

In Alexander Eulenberg et al. (1996) studies argued that the way to prevent myopia is to assure a properly functioning adrenal cortex. This could be done by assuring proper nutrition because malnutrition and defective diets play large role in causing glandular disorders and the other disturbances which give rise to myopia. A diet which has high content of carbohydrates, starches or sugars and low in proteins or fats favors the development of myopia because such diet is to be deficient in several vitamins which are important in eye health. He noted that the prevalence of school-aged children with myopia is linked to their eating habit and meal nutrition.

Alexander Eulenberg et al. (1996) also pointed that P.A. Gardiner, a London ophthalmologist has found a correlation between poor nutrition and myopia. In particular, he found that myopic children are more likely to refuse to eat foods high in animal protein, this tendency being marked to the rapid progression of myopia. Further support for the idea that myopia is caused by lack of protein in the diet was commented by Elizabeth Cass (1966) who has did the survey among 2,124 Eskimo whom lived in a traditional village setting for eyes examination. The majority of Eskimo have negligible refractive errors but their children have developed refractive error after living on the white man's food for some years even though their parents have no refractive errors. This main reason is they have changed their eating habit from a high protein to a high carbohydrate diet. (Alexander Eulenber et al., 1996)

Food choices during childhood and adolescence are important as it influences health, growth and development throughout the lifespan. Eating practices established in childhood and adolescence could determine the diet and health in adulthood (Nicklas et al., 2001). Unhealthy dietary practices during the early growing period increases the risk of developing various lifestyle-related chronic diseases including refractive error. Eating practices established during adolescence may be difficult to change in later years. It is therefore important to establish healthy dietary to prevent development of refractive error or other health problems during childhood.

2.7 Genetic trait

Refractive errors (myopia, hyperopiaand astigmatism) are complex heterogeneous disorders of the human eye and are ideal for genetic investigation. Moderate to severe refractive errors can predispose individuals to poor visual development, various types of glaucoma, misshapen corneal surfaces, premature cataracts and loss of retinal integrity which can lead to detachment. Knowledge of genetic mechanisms involved in refractive error susceptibility may allow treatment to prevent progression or to further examine genetic-environment interactions. The research done by Terri L. Young et al. (2007) stated that the cornea, the lens and the axial length are the major components which contribute to refractive error. However, the size, shapeand power of all components are determined largely by inheritance. Conformational factors such as intrauterine environment, bony orbits and eyelids can also affect eye shape and its growth.

According to Dennis S.C Lam et al (2008), children who have both myopic parents and either one myopic parent were on averagely to be myopic respectively compared to the children with no myopic parents. The effect of parental history of myopia was assessed by comparing the axial lengths and the dimensions of various ocular components between children with different numbers of myopic parents. Axial length (AL) was the longest among children with two myopic parents (mean, 23.65 mm), followed by children with one myopic parent (mean 23.51 mm) and children with no myopic parents (mean 23.47 mm). This means that the children who have longer axial length will tend to have higher probability to develop refractive error. Light needs to travel longer to reflect on eye retina if the axial length is longer. Hence, the light may not

precisely falls on eye retina to obtain clear and sharp image naturally. Children with two myopic parents also tended to have deeper vitreous chambers which lead to develop of refractive error. However, the vitreous chamber depth and lens thickness were similar between children with different parental histories of myopia in either father or mother is myopic.

Terri L Young et al. (2007) have surveyed in multiple familial aggregations and was reported a positive correlation between parental myopia and probability of myopia development in their children which indicated a hereditary factor in myopia susceptibility. In their study of the prevalence of myopia among 7-year-old children, only 7.3% of the children have refractive error when neither their parent was myopic, 26.2% of the children have refractive error when either of their parent was myopic and 45% of the children have refractive error when both parents were myopic. This survey was implying a strong role for genetics in myopia that the higher prevalence of refractive error in parents will have higher prevalence of refractive error in their children. Among seven hundred subjects survey in Chung-Ling Liang et al. (2004) research also considered that the effect from parents and siblings has extremely strong association with their development of refractive error.

Multiple familial studies have supported a high genetic effect for myopia development among children. The increase in risk to siblings of a person with refractive error has been estimated to be high probability for myopia development for themselves was suggesting a definite genetic basis for refractive error. A high degree of familial

aggregation of refractive error particularly myopia related to parental genetic was reported in the Beaver Dam Eye Study after accounting for the effects of age, sexand education. Consideration is needed to assess the role of environmental factors to genetic influences such as interactions of early-age near-work and genotype. (Terri L. Young, 2009)

2.8 Lifestyle

Seang-Mei Saw et al. (2001) comment that educational level and educational stream are positively related to myopia such as close up work activity in early childhood and tuition classes during elementary school. Most of the people in this world have realized the importance of knowledge in assuring themselves a skill to able for earn a leaving. Hence, age of starting preschool has become earlier and the education pressure on children has become greater. Nowadays, busy parents will send their children to attend many tuition classes to hope that their children able to catch up their school lesson and achieve good results. Seang-Mei Saw et al. (2001) research has ascertained the relation of students with myopia had extra tuition classes (either private or government) in primary or secondary school. These results underscore the strong influence of environment in myopia pathogenesis.

Sleep is needed for people to restore energy and release tiredness after whole day activities. However, everyone has his own individual sleeping habit. Most of the students reported that they like to sleep at night without artificial lighting in their bedrooms throughout the entire year. For these, the period of darkness was calculated to start at the

time of going to sleep (presumably when artificial lighting is turned off) until the time of first light exposure in the next day morning. As a further analysis, the association of myopia progression with hours of near work, hours of sleep and hours of darkness was determined for those students who reported myopia onset. Alternatively, daily hours of sleep have been correlated with myopia in young children. Hours of sleep was correlated with myopia or myopia progression, suggesting that it was a myopia risk factor among this young population. (Jane Loman et al 2002)

There was a research done by Kathryn A, Rose et al. (2008) showed the prevalence of myopia among 6-7 years old children of Chinese ethnicity was significantly lower in Sydney (3.3%) than in Singapore (29.1%). Children in Sydney read more books per week and did more total near work activity compared to children in Singapore but they have spent more time (13.75 hours per week) on outdoor activities than children in Singapore did (3.05 hours per week). Hence, this comparison results showed that outdoor activities are significant factors associated with the prevalence of myopia. The strong association between increased time spent outdoors and decreased myopia is associated with sports and outdoor activities. Data from Kathryn A, Rose et al. (2008) study suggested that the critical factor which influencing refractive error development is the time spent in outdoor activities rather than engagement in sports. It is because indoor sporting activity was found has no effect in influencing refractive error development, whereas outdoor sports and outdoor leisure activities showed the positive association. The research was not clearly defined whether the effect of time spent outdoors is a result of the greater viewing distances or the brighter light typical of outdoor daylight hours.

Another factor which hypothesized to contribute the differences in the prevalence of myopia may be the early educational pressures found in Singapore but not in Sydney.

Myopia is usually held to be caused by excessive close use of the eyes. Chalmers Prentice, a physician writing in 1895, explained how excessive near work leads to the inability to see in the distance. Prospective myopes or myopes would like to strain their eyes when looking at distance objects because their experience that they able saw distance objects more distinctly by making a voluntary effort to strain their eyes to bring the object image nearer. Hence, most of them will strain naturally when looking at distance objects to improve their sight acuity. (Alexander Eulenberg, Bloomington & Indiana, 1996)

2.9 Personal achievement

In accord with the bulk of epidemiological evidence, T. W. Teasdale et al. (1988) results comment that myopes in generally achieve higher intelligence test scores and higher educational levels than non-myopes. Reading may not be the sole contributor to intelligence and educational level which become associated with myopia. However, reading is used to measure the level near work activities. It is preceding reading age which may have a role associated with myopia. Higher intelligence test scores and higher educational level are believed obtained by hard work of reading, while reading need a lot of near work on reading materials.

In addition, Seang-Mei Saw et al (2007) supported that school grades is a possible indicator of either cumulative engagement in near work activity or intelligence was positively associated with myopia in Singapore children. In their studies showed that the prevalence of myopia among 62.2% of children has high scores in English language, mathematics and native language. They had significantly higher IQ scores and read more books per week compared to non myopic. Children with higher examination scores were 2.5 times more likely to be myopic compared with the lower examination scores after adjusting for age, gender, race, school, parental myopia, father's education, reading in books per week and IQ test scores. In Singapore children, there is a positive association between school academic achievement and myopia.

Confirming the widely-observed correlation, Alexander Eulenberg et al. (1996) found that the occupations that demanded more close work had a higher percentage of myopes than did the occupations that demanded less close work. In their study, there is a large proportion of cadets enter military academies with perfect vision but become nearsighted after four years of study. This is a fact sadly acknowledged by military researchers (National Research Foundataion 1979) that close work is potentially contribute to refractive error. An early proponent of this theory was Dr. Albrecht Haller (1758) who in his research wrote that myopia was caused by an excessive amount of working with small objects at a close range.