

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY  
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**PREVALENCE AND RISK FACTORS OF MYOPIA. A CASE STUDY OF  
SENIOR HIGH SCHOOL STUDENTS IN SEKYERE EAST DISTRICT OF  
GHANA.**

**A THESIS DISSERTATION SUBMITTED TO THE SCHOOL OF GRADUATE  
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AND PROMOTION**

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## DECLARATION

I declare that this thesis was written by my effort through the support of my supervisor. I therefore present it to the Department of Community Health of the School of Medical Sciences and the School of Graduate Studies for the award of Master in Public Health in Health Education and Promotion.

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## DEDICATION

I dedicate this write up to my father Dr. Kofi Boaitey, mother Mrs. Comfort Boaitey, and all my siblings for their support.

# KNUST



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## DEFINITION OF TERMS

**ACCOMMODATION:** The eye's ability to automatically change focus from seeing at one distance to seeing at another.

**AMBLYOPIA:** Also called lazy eye. Undeveloped central vision in one eye that leads to the use of the other eye as the dominant eye. Strabismus is the leading cause, followed by anisometropia. There are no symptoms. The patient may be found squinting and closing one eye to see; there may be unrecognized blurred vision in one eye and vision loss.

**ASTIGMATISM:** Condition in which the cornea's curvature is asymmetrical (the eye is shaped like a football or egg instead of a baseball); light rays are focused at two points on the retina rather than one, resulting in blurred vision. Additional symptoms include distorted vision, eyestrain, shadows on letters, squinting and double vision.

**BEST CORRECTED VISUAL ACUITY:** The best vision you can achieve with correction (such as glasses), as measured on the standard Snellen eye chart.

**CILIARY BODY:** Part of the eye between the iris and the choroid; the three form the uvea. The ciliary body's main functions are accommodation, aqueous humor production and holding the lens in place.

**DIOPTER:** Unit which measures the refractive (light-bending) power of a lens; eyecare practitioners use it in eyeglass and contact lens prescriptions. A negative number refers to nearsightedness, while a positive number refers to farsightedness.

**FLOATERS:** A dark or gray spot or speck that passes across your field of vision and moves as you move your eye. Floaters are very common and may look like clouds, strands, webs, spots, squiggles, wavy lines or other shapes.

**HYPEROPIA:** Also called farsightedness. Condition in which the length of the eye is too short, causing light rays to focus behind the retina rather than on it, resulting in blurred near vision.

**IRIS:** Diaphragm that controls the size of the pupil (an opening that lets light in).

**LENS:** The nearly spherical body in the eye that focuses light rays onto the retina.

**MACULAR DEGENERATION:** Disorder characterized by changes in the eye's macula that result in the gradual loss of central vision.

**MYOPIA:** Also called nearsightedness. Condition in which the length of the eye is too long, causing light rays to focus in front of the retina rather than on it, resulting in blurred distance vision.

**RETINA:** The sensory membrane that lines the eye; it is composed of several layers and functions as the immediate instrument of vision by receiving images formed by the lens and converting them into signals which reach the brain by way of the optic nerve.

**RETINAL DETACHMENT:** Condition where the retina separates from the choroid. Retinal detachments have many causes, including aging, surgery, trauma, inflammation, high myopia and diseases such as diabetic retinopathy, retinopathy of prematurity and scleritis. Symptoms include light flashes, floaters, a shadow coming down over your vision, blurred vision and vision loss.

**SCLERA:** The outer coat of the eyeball that forms the visible white of the eye and surrounds the optic nerve at the back of the eyeball.

**VITREOUS DETACHMENT:** Separation of the vitreous from the retina, caused by age-related vitreous shrinkage. Floaters are the typical symptom, but some people experience flashes of light as the vitreous tugs or causes traction on the retina prior to complete separation.



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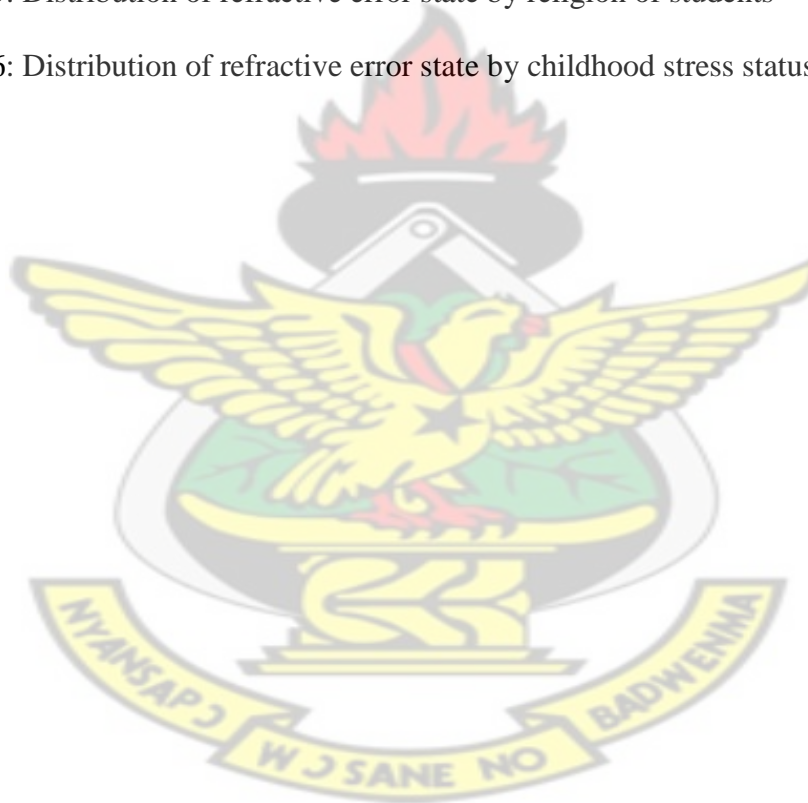


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## ABSTRACT

Myopia is a global public health problem leading to visual impairment and blinding complications. It is the most common type of refractive error and is a complex trait including both genetic and environmental factors. Numerous studies have been conducted to elucidate the aetiology of myopia. The objective of this study was to determine the prevalence of myopia and the effect of reading, writing outside class and childhood stress on the occurrence of myopia among senior high school students in Sekyere East District of Ghana.

The study was a cross-sectional study of students attending senior high schools in the Sekyere East District of Ghana. Out of the six senior high schools in the district, three were randomly selected and students were selected from these schools by systematic sampling method. Questionnaires were administered to all students and non-cycloplegic refraction was carried out for all students who failed the plus one blur test or with improvement of vision with a pin hole on the Snellen chart. Myopia for purposes of this study was defined by the investigators as spherical error of at least  $-0.50$  diopters in one eye.

The prevalence of myopia among the student was 27%. The mean total-number of hours study by the students who suffer from myopia was significantly different from the mean total-number of hours study by those who do not suffer from myopia. Childhood stress was highly associated with the occurrence of myopia. The study showed students who experience significant childhood stress are 13 times more likely to develop myopia compared to children who do not experience significant childhood stress. There was also a significant association between myopia and gender, age and socio economic status of students.

This study concludes that myopia is a significant cause of visual impairment among senior high school students in the Sekyere East District of Ghana, and is therefore an issue of public health concern among senior high school students in the district. Cost effective strategies for vision screening of school children will be very beneficial to the school health program of the Ministry of Health.

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background Information

Myopia, the most common type of refractive error, is a complex trait including both genetic and environmental factors. Numerous studies have tried to elucidate the aetiology of myopia. However, the exact aetiology of myopia is still unclear (Pan, 2011). Old-fashioned traditional medicine state that myopia is an inherited condition and the only solution to the condition is to prescribe glasses. In many papers, however, it has been reported that many people are now becoming myopic even though their parents or grandparents were not. On the other hand, life today is very different from that of our ancestors – just to mention the different working environment and changes in nutrition. Therefore, it is rather obvious that these changes in the environment have an impact on the incidence of myopia.

Myopia is the refractive anomaly of the eye in which the conjugate focus of the retina is at some finite point in front of the eye, when the eye is not accommodating. It can also be described as the refractive condition in which parallel light rays from an object at optical infinity are focused by the eye in front of the retina, with accommodation relaxed (American Optometric Association, 1997).

Myopia results from an eye having excessive refractive power for its axial length. This may be due either to the eye having a relatively long axial length or to increased dioptric power of one or more of the refractive elements (Goldschmidt, 1968). Aristotle is credited with first distinguishing nearsightedness. However the term myopia was derived by Galen from the words *myein* (to close) and *ops* (eye) (Borish, 1970).

Myopia presents with various symptoms depending on the vocation of a person and its associated visual demand. The most common symptom associated with uncorrected myopia is blurred distance vision. Myopia can be classified as simple myopia, nocturnal myopia, degenerative myopia or induced myopia. (American Optometric Association, 1997).

In emmetropic eyes, axial length and optical power are inversely correlated. An eye with greater than average optical power can be emmetropic if it is sufficiently shorter than average, as can an eye with less than average optical power if it is sufficiently longer than average. An eye with myopia is an otherwise normal eye that is either too long for its optical power or, less commonly, too optically powerful for its axial length. Corrected visual acuity may be reduced as a result of pathological changes in the posterior segment (American Optometric Association, 1997).

Myopia appears with greater prevalence in young children (Saw, 2002; Lin, 2004) which places these children at an increasing risk of developing myopia, with its associated complications. Due to these trends in the prevalence of myopia, there has been a research

focus on factors that could increase the risk of myopia. It is well established that the prevalence of myopia in children is greater if their parents are myopic. (Saw, 2002; Zadnik, 1997) but current studies according by Schmid (2013) indicate that this may not always be the case.

According to Morgan (2005), East Asian ethnicity has also been proposed as a possible risk factor for myopia. He further goes on to intimate that myopia is generally believed to have a multi factorial etiology. The rapid rise in the prevalence of myopia suggests that rapidly changing environmental factors are predominant in determining the current patterns of myopia.

## **1.2 Problem Statement**

Myopia is a global public health problem leading to visual impairment and blinding complications (Saw, 2005). According to American Optometric Association, (1997), myopia is the most common eye disorder in the world. Mavracanas, (2000) and Pararajasegaram, (1999) have shown that refractive error, and myopia in particular, is one of the five leading causes of visual impairment in the world. Kempen et al, (2004) estimated that, by the year 2020, approximately one third of the world's population (2.5 billion) will be affected by myopia alone. High myopia (myopia greater than minus 6 diopters) may be associated with glaucoma, cataract, retinal degeneration and myopic macular degeneration (American Optometric Association, 1997).



Abnormal or adverse ocular changes in degenerative myopia can include vitreous liquefaction, posterior vitreous detachment and peripapillary atrophy appearing as temporal choroidal or sclera crescents or rings around the optic disc (Goldschmidt, 1990). According to Celorio, (1991), other adverse ocular changes also includes lattice degeneration in the peripheral retina, tilting or malinsertion of the optic disc, usually associated with myopic conus, thinning of the retinal pigment epithelium with resulting atrophic appearance of the fundus, ectasia of the sclera posteriorly (posterior staphyloma), breaks in Bruch's membrane and choriocapillaris, resulting in lines across the fundus called "lacquer cracks", and Fuchs' spot in the macular area.

The observation of some of the ocular changes in isolation does not necessarily indicate pathological myopia. For example, small choroidal crescents on the temporal side of the optic disc are often seen in simple myopia. Patients with degenerative myopia may complain of floaters or flashes of light associated with retinal changes. Patients with myopia are more likely to have a retinal detachment than patients with hyperopia, and the risk for retinal detachment increases as myopia increases. (Perkins, 1975).

Myopia may have substantial social, educational, economic and personal consequences (Orfield, 2007; Saw, et al 1996). The American Optometry Association, (1997) indicates that because myopia is associated with reduced distance vision without optical correction, it can be a limiting factor in occupational choices.

### 1.3 Rationale of Study

A better understanding of the risk factors for myopia would enable better public health interventions. Such health interventions include health education efforts, to advise the public about the types and circumstances under which the onset of myopia can occur. Literature available on refractive error and myopia in Ghana so far are descriptive cross sectional studies which only seek to find prevalence.

An example of such studies is by Ovenseri-Ogbomo and Omuemu (2010), who conducted a school based cross-sectional study which was carried out to estimate the prevalence and distribution of refractive error among school children in the Cape Coast Municipality of the Central Region of Ghana. In this study, 6.9% (95% CI: 5.3–8.5) of school children examined had myopia. The clinical condition of myopia was shown to be significant among school children. This study did not seek to find the risk factors associated with myopia. Identification of risk factors of myopia is paramount in our part of the world as has been done in other places.

Khader et al's (2010) study in Jordan among students between 12-17 years of age showed that myopia was significantly associated with age, family history of myopia, computer use, reading and writing outside school. Playing sports was inversely associated with myopia but there was no association with watching television. There was a 17.6% prevalence of myopia in their study. Chaudhry, Hassan and Sheikh, (2011) also conducted a study of myopia among medical students above the age of 17 years in Pakistan and concluded that there was genetic predisposition in the causation of myopia

which has also been well established by many other studies worldwide. The amount of near work and nutritional status however did not show any significant relationship with myopia in their study.

Although several risk factors have been researched, psychological factors need to be addressed. Psychological factors that could be related to the development of myopia have to date received anecdotal mention (Dobson, 1949; Liberman, 1995) but virtually no research attention. It is also important to find the risk indicators of myopia with different environmental and socio-cultural factors different from areas where such research has been conducted. Since the risk factors of myopia are inconclusive, it will be important to carry out further research into other potentially myopigenic exposures.

#### **1.4 Hypothesis of Axial Length Growth of the Eye**

During normal ocular development in children and young adults, the axial length of the eye must closely match its optical power to ensure that the retinal image is properly focused. If the eye grows too rapidly, the image will be focused in front of the retina and the subsequent eye growth will tend to be slower. If the eye grows too slowly, however, the retinal image will be focused behind the retina, and the subsequent eye growth will tend to be faster. (Grosvenor & Goss, 1998).

The continuous biological process that attempts to balance optical power and axial growth of the eye is known as emmetropization (Yackle & Fitzgerald, 1999). Kee et al., (2007) have shown that certain exposures such as excessive near work may hinder an eye

from being emmetropized. According to Parssinen (1993), tasks of high accommodative demand such as reading and writing elicits side-to-side movement of the eyes precipitating in myopia as found in *Cohn's use-abuse theory*.

### **1.5 Cohn's Use-Abuse Theory**

*Cohn's use-abuse theory* is based on the premise that myopia is the result of use, or indeed abuse, of the eyes. The term 'school myopia' reflects this belief (Edwards, 1998) insofar as it was created to capture the apparent association between school work and the development of myopia in children (Tan, 2000). In particular, the term 'school myopia' encompasses the idea that reading and related visual tasks have a role in the development of refractive error (Saltarelli, 2004). Indeed, Cordain et al. (2002) declared that excessive near work represents the single most frequently cited environmental variable associated with juvenile-onset myopia development.

### **1.6 Hypothesis of Accommodation and Near Work**

Accommodation as a result of near work causes a substantial lag of the ocular shape as Walker et al. (2002) stated "... ocular shape had become more prolate [i.e. stretched]. This shape remained unchanged after 1 hour of sustained accommodation and then returned to baseline dimensions after 2 hours of accommodation ...Ocular shape returned to baseline dimensions after 45 minutes of accommodative relaxation." It was measured (with partial coherence interferometry) that the eye generally elongates during accommodation. Drexler et al. (1998) explained: "... by the accommodation-induced contraction of the ciliary muscle, which results in forward and inward pulling of the choroids, thus

decreasing the circumference of the sclera, and leads to an elongation of the axial eye length."

According to Mallen et al. (2006), during relatively short periods of accommodative stimulation, axial length increases in both emmetropic and myopic young adults. At higher levels of accommodative stimulation, a significantly greater transient increase in axial length is observed in myopic subjects than in their emmetropic counterparts.

Personal studies of students used in writing and reading are investigated as a possible causal factor in the development of school myopia. This is due to the fact that participation in extra studies outside the classroom differs between students. Hence personal studies may be a factor that discriminates between those students who do and do not develop myopia, or the extent to which myopia is experienced.

### **1.7 Hypothesis of Stress and Myopia**

Toxic stress can impair the connection of brain circuits and, in the extreme, result in the development of a smaller brain. Brain circuits are especially vulnerable as they are developing during early childhood. Toxic stress can disrupt the development of these circuits. This can cause an individual to develop a low threshold for stress, thereby becoming overly reactive to adverse experiences through-out life. High levels of stress hormones, including cortisol, can suppress the body's immune response. This can leave an individual vulnerable to a variety of infections and chronic health problems. (National Scientific Council on the Developing Child. Cambridge, 2005).



According to Elias (1989) school stress, stressful school environments have been linked to children's experiencing inordinate amounts of fatigue and headaches which can hinder the normal growth of organs and tissues in the body. Psychological stress has been associated with poor health in individuals across the life span and in many countries (Lin & Ensel, 1989; Marmot & Wilkinson, 1999). It is well established that psychological conflicts or other stressors can sometimes produce temporary blindness (American Psychiatric Association, 2000); therefore, it is possible that mental and emotional states experienced from childhood may influence vision, axial length, refractive power of the eye and the whole process of emmetropization.

Balacco-Gabrieli and Tundo (2000) detected significant high level of cortisol in myopes. According to Rosemond (2000), cortisol level increases under transient stress and after long-term exposure to stress; however, this is followed by a decrease of the cortisol output. Cortisol has a high impact on connective tissue by mediating reactions of the immune system, e.g. by decreasing inflammations, and by creating structurally defective connective tissue. (Trichtel & Zur, 1986). Stress may therefore be responsible for long axial length in myopes.

### **1.8 Research Questions**

1. What is the prevalence of myopia among senior high school students in Sekyere East District of Ghana?
2. What are the effects of hours spent in writing, reading outside class and childhood stress on the occurrence of myopia among senior high school students?



## **1.9 General Objective**

To determine the prevalence of myopia and the effect of reading, writing outside class and childhood stress on the occurrence of myopia among senior high school students in Sekyere East District, Ghana.

## **1.10 Specific Objectives**

1. To determine the prevalence of myopia among senior high school students.
2. To assess the effect of reading and writing outside the classroom on the occurrence of myopia among senior high school students.
3. To assess the effect of childhood stress on the occurrence of myopia among senior high school students.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

Myopia has been broadly classified as pathological and by age of onset as school age, or adult onset. Pathologic myopia, which usually presents before six years of age, is caused by abnormal and extreme elongation of the axial length of the eye, generally does not progress, and is usually associated with early retinal changes (Curt et al, 1979).

School age myopia occurs between 6 and 18 years of age and is thought to progress and stabilize by the late teens or early twenties (Morgan & Rose, 2005). According to Jones et al, (2005) and Wu et al, (2010), school age myopia is associated with higher intelligence quotient scores, more time spent reading, and less hours of exposure to sunlight as compared to non-myopic patients.

American Optometry Association, (1997) indicates that adult onset myopia occurs between 20 and 40 years of age (early adult onset) or after 40 years of age (late adult onset). It has different characteristics as compared to the school age onset myopia; specifically it is associated with focusing anomalies and near vision dominated occupations such as computer viewing (Simensen & Thorud, 1994). Myopia progression in all three groups of pathological, school age and adult onset is due to the elongation of the eye ball, resulting in the eyeball becoming egg shape (Hosaka, 1988).

The concept that myopia evolved from the use and abuse of the eyes during near vision activities was first described by Cohn in 1886 and has been traced back to Kepler (Rosenfield & Gilmartin, 1998). The assumption in most use and abuse theories is that near vision focusing such as reading and writing is somehow indirectly responsible for axial length elongation. Thus those near activities can bring about the onset of myopia.

## **2.2 Prevalence of Myopia**

The prevalence of myopia varies among countries and age groups. Chow et al. (1990) conducted a research work among 128 medical students in Singapore. The prevalence of myopia was 82%. This was higher than the prevalence of 36.8% obtained by Mavracanas et al. (2000), whose study was among Greek students aged between 15-18 years of age. Villarreal et al, (2003) obtained similar results with a prevalence of 37% among 1035 children aged between 12-13 years in Monterrey, Mexico.

A school based study conducted by Khader et al, (2010) in Amman, Jordan to determine the frequency of myopia among students aged between 12–17 years old showed that the prevalence of myopia was 17.6% with 313 children suffering from myopia. This was much lower compared to a study to estimate the frequency of myopia among medical students of Allama Iqbal Medical College in Pakistan. According to Chaudhry, Hassan and Sheikh (2011), the prevalence of myopia among medical students above 17 years of age was 57.6%.

Chow et al, (1990) conducted a study among medical students aged between 20 and 22 years of age in Singapore. Prevalence of myopia was 82% among 128 respondents. Prevalence of myopia among Singaporean males aged between 15-25 years however was 30.4% (Tay et al. 1992). This was a little less than the prevalence of myopia among 1738 Greek students between 15-18 years of age, where 36.8% of respondents according to Mavracanas et al, (2000) had myopia. Lam et al, (1999) conducted a school based study among children between 6-17 years of age in Hong Kong and found 62% out of the 142 students had myopia.

Ahuamao and Atowa, (2004) carried out a study among 2,525 school children aged 7 to 17yrs. This study, which was carried out in Abia State of Nigeria showed prevalence of 31.05% for myopia. This was much higher than a similar study done by Ovenseri-Ogbomo and Omuemu, (2010) which produced a myopia prevalence of 6.9%. This was a school based cross-sectional study which was carried out to estimate the prevalence and distribution of refractive error among school children aged between 5-19 years in the Cape Coast Municipality of Central Region of Ghana.

According to the study by Ovenseri-Ogbomo and Assien, (2010), the prevalence of hyperopia, myopia and astigmatism among children was 5.0%, 1.7% and 6.6% respectively. This was a school based cross-sectional study and was carried out to estimate the prevalence and distribution of refractive error among schoolchildren in the Agona Swedru Municipality of the Central Region of Ghana. 637 schoolchildren aged 11-18 years old were randomly selected for the study. Rose et al, (2008.b) reported a

higher prevalence than the study by Ovenseri-Ogbomo and Assien, (2010) which compared the prevalence and risk factors for myopia in 6-year and 7-year-old children of Chinese ethnicity in Sydney and Singapore. The prevalence of myopia in 6- 7 year old children of Chinese ethnicity was significantly lower in Sydney (3.3%) than in Singapore (29.1%).

The prevalence of myopia is always affected by the definition of myopia by researchers in their study. Rose et al, (2008.a) and Khader et al, (2010) defined myopia in their study as spherical error of at least  $-0.50$  diopters. In Jones et al's, (2007) study in the United States to identify whether parental history of myopia and or parent-reported children's visual activity levels can predict juvenile-onset myopia, this definition was chosen as  $-0.75$  D of myopia. The definition of myopia in this study was taken as a clinically significant cut off for providing a prescription of spectacles. According to Jones et al. (2007),  $-0.75$  D of myopia is likely to create symptoms of distance blur, and  $-0.75$  D of myopia is clearly beyond the measurement error of the auto refractors used to measure refractive error.

### **2.3 Myopia and Gender**

According to Khader et al, (2010) the prevalence of myopia was significantly higher in females (20.3%) compared to males (15.9%) ( $P = 0.02$ ). Myopia was also significantly related to age. The prevalence of myopia was lowest for the youngest age group (7.8%) of 12-year-old children and increased until it reached 20.6% for 14-year-old children. The prevalence decreased gradually for children who were much older. Yuddha et al (2008)



assessed visual impairment in school children of upper-middle socioeconomic status in Kathmandu for comparison with rural Jhapa District. Myopic visual impairment was associated with grade level, female gender, parental education, in 5th to 9th graders between the ages 9 to 16 years. Female gender was also a significant risk factor for myopia.

A vision screening study was carried out among 749 students (49.7% boys and 50.3% girls). Indian schoolchildren around Kuala Lumpur to determine whether the prevalence of myopia was higher in boys or girls between the ages of 7-18 years. There was no significant difference in the prevalence of myopia between girls and boys among Indian schoolchildren. A study on Chinese schoolchildren in Kuala Lumpur also showed the prevalence of myopia was high as compared to that of Indian schoolchildren in Kuala Lumpur. The proportion of boys with myopia was 41.5% as compared to 43.5% of girls in the Chinese schoolchildren. Chung et al. (1995) found that there was no significant difference in myopia between boys and girls. A study by Zadnik et al. (2003) in Caucasian population also found no significant difference in myopia between girls and boys although girls tend to have steeper cornea, steeper crystalline lens and shorter eyes compared to boys. Lam et al. (2004) found no difference in prevalence of myopia between sexes in Chinese schoolchildren in Hong Kong.



## **2.4 Myopia and Age**

According to Khader et al, (2010), myopia was significantly related to age. The prevalence was lowest for the youngest age group (7.8%) and increased until it reached 20.6% for 14-year-old children. After this age, the prevalence decreased gradually. Yuddha et al (2008) assessed visual impairment in school children of upper-middle socioeconomic status in Kathmandu for comparison with children in rural Jhapa District aged between 9-16 years of age. Myopic visual impairment was associated with age with prevalence of myopia increasing with older children.

## **2.5 Myopia and Socioeconomic Status**

Wong et al. (2002) in a study to relate indices of education, occupation, and socioeconomic status to ocular dimensions and refraction in an adult population, found that occupations and higher income were similarly associated with longer axial dimensions and more myopic refractions, It was demonstrated that higher educational levels, and higher income were independently associated with longer axial length and more myopic refractions in adults aged 40–81 years.

## **2.6 Myopia and Religion**

Religious practices may present a positive or negative impact on health but Donder et al. (1999) found no significant association between myopia and religion. The research was done to assess the prevalence, distribution, and demographic associations of refractive error in an urban population in southern India. This was done among two thousand five hundred twenty-two subjects of all ages.

## 2.7 Myopia and Near Work

Chow, Dhillon, Chew et al, (1990) conducted a study among 128 medical students between 20-22 years of age in Singapore and found the occurrence of myopia was associated with near work. (Tay, Au Eong, Ng et al, (1992) and (Wu, Seet, Yap et al. 2001) found near work as a result of education was associated with myopia. Tay, Au Eong, Ng et al, (1992) conducted a study among Singaporean males aged between 15 and 25 years and Wu, Seet, Yap et al, (2001) conducted their study on Singapore military conscripts aged between 16-25 years of age. In Mavracanas, Mandalos, Peios et al's . (2000) study which was done among 1738 Greek students aged between 15-18 years of age, it was found out that the development of myopia was associated with excessive near work. 108,809 Taiwan school children aged between 7 and 12 years were studied by Lin, Shih, Hsiao et al. (2001) and it was found out that myopia was associated with near work through the rigorous education system.

With regard to the activities outside school, Khader et al, (2010) had results which showed that myopic and non-myopic children differed in the time they spent on various activities. The results of Khader et al, (2010) showed an association between near work and occurrence of myopia. According to Khader et al, (2010), myopic children spent significantly more time reading and writing outside school and in computer work compared with non myopic children.

Chaudhry, Hassan and Sheikh, (2011), Jones et al, (2007) and Rose et al, (2008.a) did not present any significant statistical relationship between near work involving reading, writing and computer use in the development of myopia. Chaudhry, Hassan and Sheikh, (2011) found out that the mean reading hours per day of myopics were 3.31 hours compared to students with no refractive error who was an average of 3.60 hours daily. Similarly, the difference between daily time spent on writing activity by myopics and non-myopics was not significantly different ( $p = 0.54$ ) with myopics writing for a mean of 1.05 hours daily compared to non-myopics who did so for a mean of 0.98 hours per day. Rose et al, (2008.a) showed no significant influence of near work on refractive status.

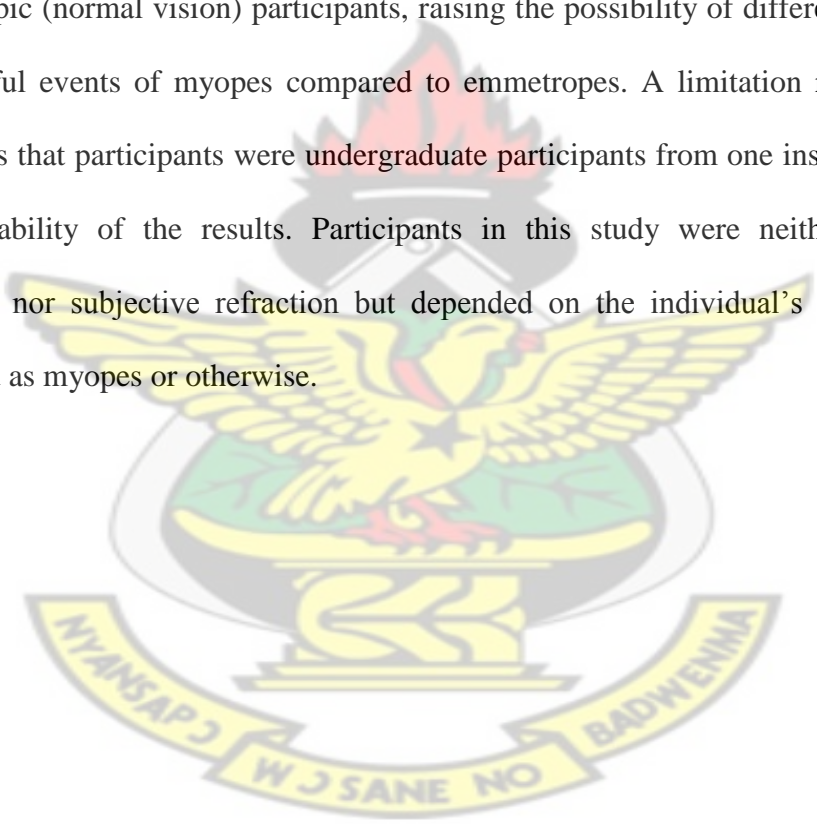
## **2.8 Myopia and Childhood Stress**

A review by Cordain, Eaton, Miller et al. (2002) of studies of myopia in primitive, urban, and rural groups, concludes that environmental factors may play a role in the etiology of myopia. Morgan and Rose (2005) give comprehensive evidence for an environmental component based on urbanization. In fact, urbanization would be expected to create a multiplicity of changes in children's lifestyles including less physical activity, more schooling and less time outdoors; exposure to artificial light; more noise; more pollution, etc.

Based on literature, there is reason to believe that environmental factors including stress may play a part in the etiology of myopia (Yoo et al 1999). Since myopia has already been shown to develop early in life, childhood stress may play an important factor in the

development of myopia. The relationship between childhood stress and myopia has however been given little attention in literature. Balacco-Gabrieli and Tundo (2000) have demonstrated that significant high levels of cortisol have been produced by transient and long-term exposure to stress in myopes.

A study in the United States by Katz (2009) shows that myopic participants who were undergraduate students reported significantly less childhood stress compared to emmetropic (normal vision) participants, raising the possibility of differential processing of stressful events of myopes compared to emmetropes. A limitation reported for this study was that participants were undergraduate participants from one institution, limiting generalizability of the results. Participants in this study were neither subjected to objective nor subjective refraction but depended on the individual's complaint to be classified as myopes or otherwise.



## **CHAPTER THREE**

### **METHODOLOGY**

#### **3.1 Study Type and Design**

The study was carried out in schools and it was a cross-sectional study of students attending senior high schools in Sekyere East District of Ghana.

#### **3.2 Profile of Study Area**

The Sekyere East District was created in 1988 and is one of the 27 districts in the Ashanti Region of Ghana. It has Effiduase as the district capital. The district is located in the North-eastern part of the region, it lies approximately between Latitude  $6^{\circ} 45'$  -  $7^{\circ} 32'$  North and Longitude  $0^{\circ} 22'$  West. The district shares common boundaries with some districts in Ashanti Region.

The district shares boundaries with Afigya Sekyere to the north-west, Sekyere West to the west, Ashanti Akim North to the south-east and Ejisu-Juaben to the south-west. It also shares boundaries with Sene and Atebubu Districts in the Brong Ahafo Region and Kwahu North District in the Eastern Region. Sekyere East District is the largest of all the twenty seven (27) Districts in Ashanti and covers a total land area of about 4,231.4 sq km. Towns in this district are Effiduase, Asokore, Oyoko, Seniagya, Dadease, Drobonso, Sekyere, Baniko, Nkwankwanua, Abotanso, Ntunkumso, Senkye (Senchi), Okaekurom, Pepease, Anyinofi, and Bomen.



In terms of ethnicity the district is quite homogenous, particularly in the southern part where the indigenous people (the Ashantis) and other Twi speaking Akan group who are the majority co-exist with the few Northern tribal groups such as the Dagabaas, Kotokolis, Fulanis and others. In the northern (Afram Plains) portion of the district, the Akan land owners co-exist with the predominant migrant farmers of northern descent such as the Moshies, Konkonbas and the Krachies as well as fishermen who are mostly Ewes and Gas. The indigenous people (Ashantis) constitute 70.6% of the population in the district, tribes from the North 27%, Ewes and Gas 2.1% and non Ghanaians 0.3%.

The district has six senior high schools. These are Tweneboa Kodua Secondary School, Effiduase Secondary/Commercial School, Asokore T.I. Ahamadiyya Secondary School, Dadease Agricultural Senior High School, Tijaniyya Senior High School and Westphalian Senior High School. Between 2003 and 2005, the total enrolment in schools increased from 3045 to 3780.

For effective management, the district has been demarcated into five sub-districts. They are Effiduase/Asokore, Mponua, Bira - Onwam, Kumawu and Afram Plains. There are fourteen government and non-government health facilities in the district. The hospitals are Effiduase District Hospital, Asokore Ahamadiyya Hospital and Oyoko Westphalian Hospital. These last two hospitals are not-government hospitals.



Government health centres in the district are located at Kumawu, Woraso, Banko, Akokoaso, Okaikrom and Anyinofi. Other non-governmental health centres are at Seniagya, Drobonso and Sekyere. All the fourteen facilities provide curative care on twenty-four hour services delivery, with Effiduase Hospital functioning as a referral centre. The three hospitals at Effiduase, Asokore, Oyoko and the health centre at Kumawu have laboratory facilities but the rest have none. Surgical operations are also performed at Effiduase, Westphalian and Ahamadiyya hospitals. The Westphalian Hospital is a specialist hospital for eye care.

### **3.3 Study Population**

The total number of students in the three selected schools who were present on the day of data collection was 1880.

### **3.4 Sample Size and Sampling Techniques**

Using the expression  $n = Z^2 (1-p)(p)/b^2$  (where  $n$  = minimum sample size,  $p$  = anticipated prevalence [assumed to be 15%],  $b$  = desired error bound taken as 5% and  $Z$  = the standard score at 95%), a minimum sample of 196 was calculated. To account for a 10% non response and missing data rate, the sample size became 216 and this was rounded up to 220.

Out of the six senior high schools in the district, three were selected by simple random sampling. The three selected schools were Asokore T.I. Ahamadiyya Secondary School, Dadease Agricultural Senior High School, and Wesphalian Senior High School. Students were selected from these schools by systematic sampling method.

### **3.5 Data Collection Techniques and Tools**

Institutional Ethics approval to carry out the study was obtained from the Committee on Human Research, Publications and Ethics of the Kwame Nkrumah University of Science and Technology (KNUST). Additionally, permission was sought and obtained from the local health service authority in the district. Authorities of senior high schools were asked for permission for students to participate in the study and heads of selected schools were briefed on the purpose of the research.

Before commencement of field work, the clinical team was briefed on the purpose of the study and received training on carrying out Visual Acuity Tests. Members of the research team were also trained on the instructions required in filling out questionnaire. The questionnaire was designed with the help of an ophthalmologist. The views obtained were used to modify the questionnaire accordingly and these were administered to all students by trained members of the research team who explained the purpose of the study and how to complete the questionnaire properly. The students were asked to fill the questionnaire independently and in privacy.

Consent forms were signed by students before Visual Acuity Tests were conducted. Non-cycloplegic refraction was done where appropriate and final prescription and the best-corrected Visual Acuity were recorded. Students afterwards took their time to fill questionnaire in private. Information on visual acuity and ophthalmic refraction was collected on the filled questionnaire and checked for completeness.

### 3.6 Clinical Examination

Non-cycloplegic refraction was carried out for all students who failed the “plus one blur test” or with improvement of vision with a pin hole on the Snellen chart. This is similar to the protocol used by Adegbehingbe et al. (2005) in their study of students in Nigeria in order not to disrupt academic work for the day used non-cycloplegic method of refraction. To ensure that accommodation was relaxed, a +1.50 D lens was used to fog the eye monocularly during refraction.

Visual acuity (VA) was measured with the Snellen chart at a distance of 6 metres. Children who wore glasses also had their VA taken while they removed their glasses and refracted. Students who read 6/9 or worse were refracted. Those who read 6/6 or better had their VA measured again with a +1.50 D. If the VA was 6/9 or worse they were also refracted.

### **3.7 Pre-Testing**

The data collection techniques and tools for the study were pretested with 75 students of the in Juaben Senior High School in Ejisu-Juaben District . Sekyere East District shares boundary with Ejisu-Juaben to the south-west. Pre-testing was done to test the adequacy of the research instrument and for assessing the feasibility of the survey. Through pre-testing, some questions which were not very clear to the students were identified. Those questions were modified to give a better understanding to the respondents before the survey. Logistical problems were also identified where it was found that two optometrists were not enough to perform refraction and another optometrist was added to the final survey. Collecting preliminary data during pre-testing aided in arriving at a suitable sample size. Out of the 78 students who were randomly selected, 12 had myopia representing a prevalence of 15% which was factored in arriving at the final sample size.

### **3.8 Data Handling, Storage and Analysis**

Data collected from each facility was kept in an envelope, labelled and kept safely under lock and key for analysis. Data was collected using questionnaires and they were checked for accuracy and completeness in the field and kept in envelopes under key and lock. The data were double entered by pairs of data clerks and consistency checks were run on batches of data sets to pick up errors which were cleaned. Data entry started shortly after data collection had started and run concurrently with data collection for the rest of the data collection period. Final data cleaning lasted two months.

The final data sets were kept on a pass-worded computer at the Department of Ophthalmic Practice at the Dosonec Health Institute and were only accessible to the principal investigator and the data manager. The consent forms were kept separately in a locked safe at the Department. No imputations were done for missing data. All analyses were conducted using only students for whom complete data were available. Data analysis was done with STATA (2010) as well as Microsoft Excel (2007; Microsoft). A baseline comparison of myopes and emmetropes was carried out to compare age, sex, religion, number of hours spent in reading and writing after class and exposure to childhood stress.

### **3.9 Ethical Consideration**

In this research study, the students were assured of the confidentiality of information given. Informed consent was sought from participants. Participants were also assured that they have the right to withdraw from the study at any stage and will not suffer any consequences for doing so. There was no coercion of participants at any stage of research work.

### **3.10 Limitations of Study**

Non-response is a particular problem that could likely affect the study and could result in bias due to the fact that the characteristics of non-responders differ from responders. The purpose of the study was spelt out through written and oral communication and efforts were made to build rapport to remove perceptions and prejudices of participants which could result in non-response.



The study depended on good recall to provide information on exposure. This could introduce systematic error due to differences in the accuracy or completeness of the recollections of study participants regarding events or experiences in the past. Participants were instructed to answer questionnaires in a conducive environment free from distractions and invasion of privacy.

### **3.11 Definition of Variables**

Myopia for purposes of this study was defined by the investigators as spherical error of at least  $-0.50$  diopters in one eye. Information on age, sex, religion and socioeconomic status was collected. Near-work activity (visual task performed at a near distance) was measured and questions were asked about the average amount of time in hours per day spent on near-work activity outside school on days they had class (Monday – Friday) and days where there was no class sessions (Saturdays and Sundays). Individual near-work activity tasks used were reading and writing after school,

The socioeconomic status of the students (SES) was inferred from the educational level of their parents. As a proxy for estimating the SES of students, parents highest level of education, was used as an indicator. Students with at least a parent with highest level of education at the primary school level or less were assigned in the low SES. Students having a parent with the highest level of education at the secondary or vocational levels were classified as middle SES while those with any parent who attained the tertiary level was classified in the high SES group.



## CHAPTER FOUR

### RESULTS

#### 4.1 Description of Sample

Out of the 220 respondents, students with amblyopia and infectious eye conditions were excluded from the examination which brought the number down to 202. Out of 202 students who were examined and interviewed, 82 were males and 120 females constituting 41% and 59% respectively. Out of the 202 respondents, 39 (19%) of respondents were classified as belonging to the high Socio Economic Status (SES), 109 (54%) were in the middle Socio Economic Status (SES) and 54 (27%) in the low Socio Economic Status (SES).. A total number of 134 (66%) respondents were Christians, 54 (27%) were Muslims and 14 respondents (7%) practiced Traditional African Religion.

**Table 4.1: Prevalence of myopia among Senior High School students**

	<b>Frequency</b>	<b>Percent</b>
Myopes	54	27
Non-myopes	148	73
Total	202	100.0

Out of the 202 students sampled, 54 were suffering from myopia. The prevalence of myopia among the student was 27%.

**Table 4.2: Distribution of refractive error state by gender of students**

	<b>Emmetropes</b>	<b>Myopes</b>	<b>Total</b>
Female	48 (55%)	41 (76%)	89
Male	40 (45%)	13 (24%)	53
Total (p=0.01)	88 (100%)	54 (100%)	142

Among myopes, 76% were females and 24% % were males. Pearson Chi-Square test of association showed a test statistic of 6.539 with a p-value of 0.01. There were significantly more female students suffering from myopia than males.

**Table 4.3: Distribution of refractive error state by age of students**

<b>Age</b>	<b>Emmetropes</b>	<b>Myopes</b>	<b>Total</b>
10-15	17	5	22
16-20	63	34	97
21-25	7	9	16
>25	1	6	7
Total(p=0.009)	88	54	142

From chi-square test (p-value=0.009) shows there is a significant relationship between age and myopia. Older students suffer more myopia than younger students.

**Table 4.4: Distribution of refractive error by socio economic status**

<b>Socio Economic Status</b>	<b>Emmetropes</b>	<b>Myopes</b>	<b>Total</b>
Low	12 (14%)	26 (48%)	38
Middle	51 (58%)	24 (44%)	75
High	25 (28%)	4 (8%)	29
Total (p<0.001)	88 (100%)	54 (100%)	142

Among myopes, 48% were of Low SES, 44% were of Middle SES and 4% were of High SES. This indicates that socio economic status of student is significantly associated with myopia (p<0.001) Socioeconomic status of students is significantly associated to myopia. It is evident that lower socioeconomic status is associated to myopia and as one climbs up the socioeconomic status ladder the less one is likely to suffer from myopia.

**Table 4.5: Distribution of refractive error state by religion of students**

	<b>Emmetropes</b>	<b>Myopes</b>	<b>Total</b>
Christians	61 (69%)	35 (65%)	96
Moslems	23 (26%)	16 (30%)	39
Traditionalists	4 (5%)	3 (5%)	7
Total (p=0.85)	88 (100%)	54 (100%)	142

Among myopes, 65% were Christians, 30% were Moslems and 5% were Traditionalists. A chi-square test of association between myopia status and religious affiliation of students reported showed that there was no association between them (p-value 0.85).

#### 4.2 Comparing the mean total hours of study by myopic and the non-myopic students

An analyses of the mean total house of study was done between myopic and non myopic student and it was revealed that those suffering from myopia have higher mean total number of hours of study 7.4 hours compared to 5.6 hours for non myopic students. Further analyses revealed that there was a significant difference ( $p<0.01$ ) between the total hours of study for both those suffering from myopia and those who are not. The mean total hours of those who are myopic is significantly higher than those without refractive error. The significantly higher number of hours spent by myopes in studying compared to non myopic students implies that there is an association between long hours of reading and writing with myopia.

**Table 4.6: Distribution of refractive error state by childhood stress status**

CHILDHOOD STRESS	Emmetropes	Myopes	Total
NO	77 (88%)	18 (33%)	95
YES	11 (12%)	36 (67%)	47
Total ( $p<0.001$ )	88 (100%)	54 (100%)	142

Among myopic students, 67% reported suffering from childhood stress and 33% did not suffer from childhood stress and there was a significant association between childhood stress and myopia ( $p<0.001$ ).

## CHAPTER FIVE

### DISCUSSION

#### 5.1 Prevalence of Myopia

The occurrence of myopia varies in different countries as well as in different localities. (Resnikoff et al. 2004). This study was done among students aged 11-26 years. The prevalence of myopia in this study was 27%. This was lower than the prevalence of myopia of 36.8% obtained by Mavracanas, Mandalos, Peios et al. (2000), whose study was among Greek students aged between 15-18 years. Prevalence of myopia in our study was also lower than the prevalence obtained by Ahuamao and Atowa, (2004) who carried out a study among school children aged 7 to 17 years in Abia State of Nigeria with a prevalence of 31.0% for myopia. Prevalence of myopia obtained in this study was also lower than the prevalence in a study by Tay et al. (1992) among Singaporean males aged between 15-25 years, who had a prevalence of was 30.4%.

Chow, Dhillon, Chew et al. (1990) had results about three times higher than results obtained in our study. Prevalence of myopia was 82% conducted among medical students aged between 20 and 22 years of age in Singapore. This group of medical students were much older than high school students and course of study and these differences could have accounted for the difference in prevalence. Lam et al. (1999) conducted a school based study among children between 6-17 years in Hong Kong and obtained much higher prevalence than our study with 62% out of the 142 students suffering from myopia. Our results was also lower than results obtained by Villarreal, Ohlsson, Cavazos et al. (2003) who obtained similar results with a prevalence of 37% among 1035 children aged

between 12-13 years in Monterrey, Mexico. It was also lower than results obtained by Sheikh (2011) who conducted a study among medical students of Allama Iqbal Medical College in Pakistan above 17 years of age and came out with prevalence of 57.6%.

Prevalence of myopia obtained from our study was higher than the prevalence of myopia among school- children in Amman, Jordan which was 17.6% among students aged between 12–17 years old conducted by Khader et al. (2010). Interestingly, the prevalence of myopia in our study was much higher than studies done in Ghana. Our prevalence was higher than a study done by Ovenseri-Ogbomo and Omuemu, (2010) which produced a result of 6.9% prevalence of myopia among school children aged between 5-19 years in the Cape Coast Municipality of Central Region of Ghana. The prevalence was much higher than a school based cross-sectional study among students aged 11- 18 years in the Agona Swedru Municipality of the Central Region of Ghana done by Ovenseri-Ogbomo and Assien, (2010), which had prevalence of 1.7%.

Rose et al, (2008.b) compared the prevalence and risk factors for myopia in 6- 7 year old children of Chinese ethnicity in Sydney and Singapore. The prevalence of myopia in these children was significantly lower. In Sydney this was 3.3% which was lower than our reported prevalence and the prevalence of children in Singapore (29.1%) was higher than our reported prevalence. The prevalence of myopia is always affected by the definition of myopia by researchers in their study. Students involved in this research were much younger than the ones used in our study which could have accounted for this difference.



Different definitions of myopia may contribute to the differences in prevalence between our study and others. Jones et al, (2007) study in the United States for example chose the definition of myopia as  $-0.75$  D. The definition of myopia in our study was chosen as  $-0.50$ D in at least one eye. Prevalence of myopia in our study did not include those with myopia and astigmatism in the same eye. Thus Equivalent Sphere for respondents with both astigmatism and myopia in one eye was not calculated to classify them as myopes or otherwise. Disparities of classifying myopia may contribute to different prevalence in our study and that of other researchers. Different age group of subjects used may also contribute to different figures of prevalence.

## **5.2 Myopia and Gender**

Female students were significantly more likely to suffer from myopia in our study ( $p<0.02$ ). This results was similar to a study conducted by Khader et al, (2010) in Amman, Jordan where the prevalence of myopia was significantly higher in females (20.3%) compared to 15.9% of males ( $p<0.02$ ). Our results was also consistent with a study by Yuddha et al. (2008) assessing visual impairment in school children aged between 9 – 16 years of upper-middle socioeconomic status in Kathmandu compared to children from rural Jhapa District. It was concluded that the female gender was a significant risk factor for myopia. Females living in areas where these studies were conducted may be more at risk of other exposures which contributes to the development of myopia. It is interesting to note that other studies did not find the female gender as a risk factor of the development of myopia. A vision screening study was carried out among 749 Indian schoolchildren around Kuala Lumpur to determine whether the

prevalence of myopia was higher in boys or girls between the ages of 7-18 years. There was no significant difference in myopia between girls and boys among the Indian schoolchildren.

A study on Chinese schoolchildren in Kuala Lumpur also showed the prevalence of myopia in Chinese children was higher than those of Indian schoolchildren in Kuala Lumpur. The proportion of boys with myopia was 41.5% as compared to 43.5% of girls and there was no statistically significant difference in gender. A study by Zadnik et al. (2003) in Caucasian populations also found no significant difference in myopia between girls and boys although girls tended to have steeper corneas, steeper crystalline lenses and shorter eyes compared to boys. Lam et al. (2004) found no difference in prevalence of myopia between sexes in Chinese schoolchildren in Hong Kong. Further research is needed to determine the differences in lifestyle and other exposures which might offer an explanation to what makes the female gender a risk factor in certain places while other areas do not report similar findings.

### **5.3 Myopia and Age**

There was a significant relationship between age and myopia in our study ( $p$ -value=0.009) with older students suffering more myopia than younger students. This was similar to results obtained by Khader et al, (2010) who conducted a study in Jordan among students between 12-17 years of age. Yuddha et al (2008) obtained similar results where school children of upper-middle socioeconomic status in Kathmandu in rural Jhapa District aged between 9-16 years of age were assessed. From his study, myopic visual

impairment was associated with age with prevalence of myopia increasing with older children. Older students may have more risk of suffering from myopia as a result of more exposure to environmental factors which precipitates myopia. Older students may also have more demanding work in school which may require them to do more reading and writing which can increase the axial length of the eye and put them at greater risk of developing myopia.

#### **5.4 Myopia and Socio Economic Status**

Our student found out that students of high socioeconomic status had significantly lower prevalence of myopia ( $p < 0.001$ ) than students in the middle socioeconomic status in our study. Prevalence of myopia among students of low socioeconomic status had a significantly higher prevalence of myopia. ( $p < 0.001$ ). It can be inferred from our study that the higher a student's socioeconomic status, the lesser the likelihood of developing myopia.

Our results are consistent with a study done by Wong et al (2002) which found that higher socioeconomic status was associated with longer axial dimensions and more myopic refractions. It was demonstrated in their study that higher socioeconomic status was independently associated with longer axial length and more myopia among adults aged 40–81 years.

## 5.5 Myopia and Religion

Religious bodies may have practices that may expose one to the development of a disease condition. Religion in our study is a predictor variable which was not found to be significantly related to myopia. ( $p=0.85$ ); Hence we can report that there was no association between religion and myopia.

## 5.6 Near Work and Myopia

In our study, those suffering from myopia reported higher mean number of hours of reading and writing after class than those without refractive error and this difference was found to be statistically significant. ( $p=0.01$ ). This supports *Cohn's use-abuse theory* which associates myopia with long hours of near work. Result from our study therefore associates near work to the development of myopia and more hours used in reading and writing after class.

Our study is consistent with a similar study by Khader et al. (2010) in Amman, Jordan among students aged between 12–17 years, which showed that myopic and non-myopic children differed in the time they spent on various activities. The results showed an association between near work and occurrence of myopia. According to Khader et al, (2010), myopic children spent significantly more time reading and writing outside school compared with non myopic children, a conclusion similar to ours.

Our study showed that participation in extra studies was a possible risk factor in the development of myopia and this was based on the assumption that participation in extra studies outside the classroom differed between students and could be a factor that discriminates between those students who develop myopia and those who do not and this might influence the extent to which myopia is experienced.

From the observations made by Walker et al. (2002), Drexler et al. (1998) and Mallen et al. (2006), it can be postulated that students who spent more hours reading and writing after class had more sustained accommodation. This sustained accommodation brought about more contraction of the ciliary muscles, which resulted in forward and inward pulling of the choroids, thus decreasing the circumference of the sclera, and leading to the elongation of the axial eye length. Thus students, who were myopic, significantly spent more time reading and writing with more sustained accommodation.

Chaudhry, Hassan and Sheikh, (2011), Jones et al, (2007) and Rose et al, (2008.a) however had results which differed from our study and did not present any significant statistical relationship between near work in the form of reading, writing and computer use to the development of myopia. Chaudhry et al, (2011) had mean reading hours per day of 3.31 for myopic students whereas students with no ocular disease had an average of 3.60 hours daily of reading hours . Similarly, the difference between daily time spent on writing activity by myopics and non-myopics was not significantly different ( $p = 0.54$ ). Myopics had a mean writing time of 1.05 hours daily compared with a mean of 0.98 hours per day.



The difference in findings may result from the different definitions of myopia and the differences in age of the groups which were selected. It is possible that the fact that the number of minutes used for breaks between studies was not factored in our studies may also have resulted in differences of the findings obtained. Breaks taken while reading and writing relax accommodation but this was not factored in our study and other studies to determine the association between myopia and near work such as reading and writing. More research is needed to factor habits of break while writing and reading and how it affects the development of myopia.

### **5.7 Myopia and Childhood Stress**

Our study found out that there is an association between childhood stress and myopia and that stress may be a contributing factor in the development of myopia. Students who suffer significant childhood stress in our study were 13 times more likely to suffer from myopia than those who did not suffer from significant childhood stress.

Our findings differ from those of a study done in the United States by Katz (2009) among undergraduate students whereas our students were high school students. The study showed that myopic participants who were undergraduate students reported significantly less childhood stress than emmetropic (normal vision) participants. According to Katz (2009), her findings raise the possibility of differential processing of stressful events between myopes and emmetropes and they state that it is also possible that the differences observed could be attributable to the differences in age groups of the participants of our study compared to those in the United States.



The difference in our results may be partly as a result of different methods used in classifying myopes. Katz (2009) relied on individual complaints to classify myopes and emmetropes. Our research classified myopes using subjective refraction. Difference in findings may also be due to the fact that Katz (2009) sampled undergraduate participants from one institution compared to our study which sampled children from 3 different schools.

It is very clear from our findings that myopia was linked to childhood stress. From the theory of Elias (1989) he is of the opinion that school stress, stressful school environments have been linked to children's experiencing inordinate amounts of fatigue and headaches which can hinder the normal growth of organs and tissues in the body. Balacco-Gabrieli and Tundo (2000) detected significant high level of cortisol in myopes. According to Rosemond (2000), cortisol levels increases under transient stress and following long-term exposure to stress; however, this is followed by a decrease in the output of cortisol. Cortisol has a high impact on connective tissue by mediating reactions of the immune system, e.g. by decreasing inflammations, and by creating structurally defective connective tissue. (Trichtel and Zur, 1986). High production of cortisol as a result of transient stress in childhood and long term exposure to stress may have therefore decreased cortisol output and had impact on connective tissue which produced long axial length resulting to the development of myopia.

It can therefore be inferred from our study that childhood stress affects the normal growth of the axial length of the eye. This can precipitate the development of myopia. Our findings makes us to infer that mental and emotional states experienced from childhood may influence vision, axial length, refractive power of the eye and the whole process of emmetropization.

# KNUST



## CHAPTER SIX

### CONCLUSIONS AND RECOMMENDATIONS

#### 6.1 Conclusion

This study concludes that myopia is a significant cause of visual impairment among senior high school students in the Sekyere East District of Ghana, with a prevalence of 27%. , and is therefore be an issue of public health concern among senior high school students in the district.

Childhood stress is highly associated with the occurrence of myopia and this study has shown that both the home and school environment can serve as sources of childhood stress which may put an individual at risk. Students who experience significant childhood stress are 13 times more likely to develop myopia compared to children who do not experience significant childhood stress.

The study concludes that extra hours used in personal studies can put an individual at risk of developing myopia as demonstrated by the fact that the mean number of hours used for studies by myopes was significantly higher than those students without any refractive error. Socio economic status was found to be associated with the occurrence of myopia and those of higher socioeconomic status had significantly lower risk of developing myopia.

## 6.2 Recommendations

It is recommended that cost-effective strategies for vision screening of school children be incorporated into the school health program of the Ministry of Health and the Ministry of Education in order to prevent the devastating impact of myopia on student's education and development, then such cost-effective strategies will prove essential.

The Ministry of Education should revise and redesign school curriculum. Our school systems should include more field trips and practical experiences where students are not forced to strenuously do so much near work to grasp theoretical concepts which can increase the risk of myopia.

It is recommended that the Ministry of Education create and strengthen counseling services from basic education through to senior high school. Children during the teenage years have many challenges and feel the effects of stress. Times of special changes like divorce, a death in the family, or a move can be stressful. Effective counseling in schools is needed to support parents and guardians to adjust students to stress.

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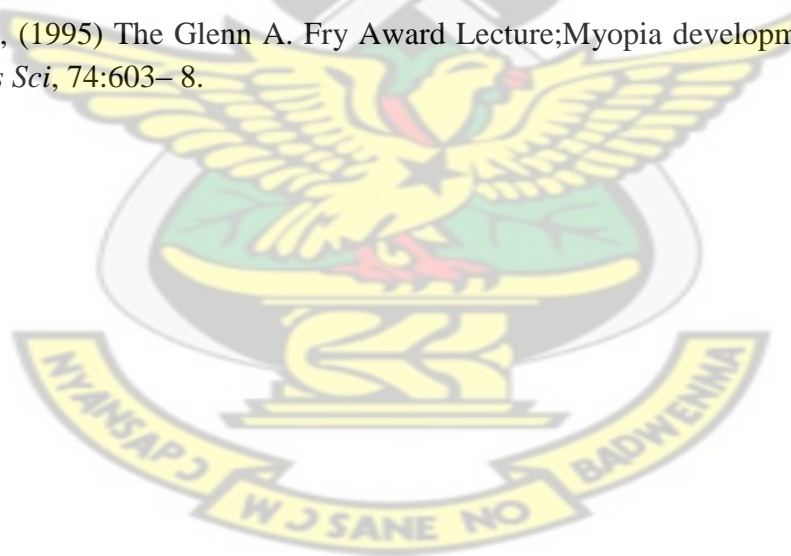
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## APPENDICES

### Appendix A

#### INTRODUCTION OF QUESTIONNAIRE

Myopia, the most common type of refractive error, is a complex trait including both genetic and environmental factors. Numerous studies have tried to elucidate the aetiology of myopia. However, the exact aetiology of myopia is still unclear. Myopia is the refractive anomaly of the eye in which the conjugate focus of the retina is at some finite point in front of the eye, when the eye is not accommodating. This results in blur vision especially at distant vision.

The aim of the research is to determine the prevalence of myopia among senior high school students, assess the effect of near work and childhood stress on the occurrence of myopia.

You have been randomly selected to be part of this study. The information you provide is totally confidential and will not be disclosed to anyone. It will only be used for research purposes. Your name and address will not be required and will not be found on our records. Your participation is voluntary and you can withdraw from the survey after having agreed to participate. You are free to refuse to answer any question that is asked in the questionnaire. Please read carefully and tick the brackets as appropriate.

## DEMOGRAPHIC DATA

1. Gender : ☐ Male      ☐ Female
2. Age: ☐ 10-15      ☐ 16-20      ☐ 21-25      ☐ More than 25
3. Religion: ☐ Christian      ☐ Muslim      ☐ Traditionalist      ☐ Other. Please specify.....
4. What is the highest level of education your parent/guardian completed?  
☐ Primary school only (or less)  
☐ Secondary school  
☐ Intermediate between secondary level and university (e.g. technical training)  
☐ University or college or equivalent

## READING AND WRITING HABITS

5. How many **hours per day** do you use for personal studies in reading and writing during weekdays (Monday to Friday)? .....
6. How many **hours per day** do you use for personal studies in reading and writing during weekends (Saturday and Sunday)? .....
7. Do you have difficulty reading from the blackboard in class?  
Yes [   ]                      No [   ]

8. Have there been moments where you have to move to a front seat before you are able to comfortably read from the blackboard?

Yes ☐ No ☐

## RELATIONSHIP WITH PARENTS/GUARDIANS/ HOUSEHOLD MEMBERS

When you were growing up, during the first 18 years of your life . . .

9. Did your parents/guardians or a household member ever insulted, shouted or humiliated you? Yes ☐ No ☐

10. If Yes, how often did they insult, shout or humiliate you?

☐ Many times ☐ A few times ☐ Once ☐ Not applicable

11. Did your parents/guardians or a household member apply corporal punishment such as the use of cane, stick or belt on you?

Yes ☐ No ☐

12. If Yes, how often did you receive corporal punishment?

☐ Many times ☐ A few times ☐ Once ☐ Not applicable

13. Are there times your parents/guardians were unable to provide basic needs such as food, clothing and shelter?

Yes ☐ No ☐

14. If **Yes**, how often did your parents/guardians failed to provide you with basic needs such as food, clothing and shelter?

☐ Many times      ☐ A few times      ☐ Once      ☐ Not applicable

## **FAMILY ENVIRONMENT**

**When you were growing up, during the first 18 years of your life . . .**

15. Did your parents/guardians have problem with hard drugs or alcohol?

Yes ☐      No ☐

16. Did you live with parents/guardians or a household member who was depressed, mentally ill or suicidal?      Yes ☐      No ☐

17. Did you live with parents/guardians or a household member who was ever sent to jail or prison?      Yes ☐      No ☐

18. Was parents/ guardians or a household member hospitalized or suffered from any physical disability?      Yes ☐      No ☐

19. Were your parents/ guardians ever separated or divorced?

Yes ☐      No ☐

20. Did your mother, father, guardian or a household member die?

Yes ☐

No ☐

21. Did a parent, guardian or a household member yell, scream, insult or humiliate you?

☐ Many times

☐ A few times

☐ Once

☐ Never

22. Did a parent, guardian or a household member threaten to, or actually, abandon you or throw you out of the house?

☐ Many times

☐ A few times

☐ Once

☐ Never

23. Did someone touch or fondle you in a sexual way when you did not want them to?

☐ any times

☐ A few times

☐ Once

☐ Never

24. Did someone make you touch their body in a sexual way when you did not want to?

☐ Many times

☐ A few times

☐ Once

☐ Never

25. Did someone attempt or actually have oral, anal, or vaginal intercourse with you when you did not want them to?

☐ Many times

☐ A few times

☐ Once

☐ Never



26. Did you see or hear a parent or household member in your home being slapped, kicked, punched or beaten up?

☐ Many times      ☐ A few times      ☐ Once      ☐ Never

27. Did you see or hear a parent or household member in your home being hit or cut with an object, such as a stick (or cane), bottle, club, knife, whip etc.?

☐ Many times      ☐ A few times      ☐ Once      ☐ Never

### **RELATIONSHIP WITH PEERS, TEACHERS AND SCHOOL ENVIRONMENT**

**When you were growing up, during the first 18 years of your life . . .**

28. Were you ever bullied in school?

Yes ☐      No ☐

29. If **Yes**, how often were you bullied?

☐ Many times      ☐ A few times      ☐ Once      ☐ Not applicable

30. Were you ever teased by peers?

Yes ☐      No ☐

31. If **Yes**, how often were you teased?

☐ Many times      ☐ A few times      ☐ Once      ☐ Not applicable

32. Were you involved in physical fights?

☐ Many times      ☐ A few times      ☐ Once      ☐ Never

33. Have you ever been shouted at or embarrassed by a teacher?

Yes ☐      No ☐

34. If **Yes**, how often have you been shouted at or embarrassed by a teacher?

☐ Many times      ☐ A few times      ☐ Once      ☐ Not applicable

35. Were there times you received corporal punishment such as caning, being whipped or slapped by a teacher?

☐ Many times      ☐ A few times      ☐ Once      ☐ Never

36. Have you ever failed in an important exam in school?

Yes ☐      No ☐

37. If **Yes**, how often have you failed in an important exam in school?

☐ Many times      ☐ A few times      ☐ Once

38. Were there times you had to repeat for a class?

☐ Many times      ☐ A few times      ☐ Once      ☐ Never

Thank you.