

**BINDURA UNIVERSITY OF SCIENCE EDUCATION**  
**FACULTY OF SCIENCE AND ENGINEERING**  
**DEPARTMENT OF OPTOMETRY**



**PATTERN AND DISTRIBUTION OF REFRACTIVE ERRORS AMONG PRIMARY  
SCHOOL CHILDREN IN BINDURA TOWN.**  
**PRESENTED BY ABIGAIL MBEVI MASUKA**

**B191329A**

**A RESEARCH PROJECT SUBMITTED IN PARTIAL FULLFILMENT OF THE  
REQUIREMENTS FOR THE BACHELOR OF SCIENCE (HONOURS) DEGREE IN  
OPTOMETRY.**

**NOVEMBER 2022**

**SUPERVISOR: DR M. A. KWARTENG**

## DECLARATION

I ABIGAIL MBEVI MASUKA declare that the **PATTERN AND DISTRIBUTION OF REFRACTICE ERRORS AMONG PRIMARY SCHOOL CHILDREN IN BINDURA TOWN** hereby submitted to the Bindura University of Science Education, in partial fulfilment of Honours degree in Optometry has not previously been submitted by me for a degree at this or any other university; that it is my own work in design and in execution.

\_\_\_\_\_  
MASUKA A. M (STUDENT)

\_\_\_\_\_  
DATE

\_\_\_\_\_  
DR M. A. KWARTENG (SUPERVISOR)

## **DEDICATION**

I dedicate this work to my family, my mother Milliam Chigarire and to my brothers Gibson and Robert Masuka.

## **ACKNOWLEDGEMENTS**

Firstly, I would like to thank the Lord Almighty for giving me strength and wisdom throughout this whole study.

Secondly, I would like to show my gratitude to my supervisor; Doctor M A Kwarteng. Thank you for your guidance and invaluable advice.

Thirdly, I would like to thank my mother M Chigarire and my brothers R and G Masuka for their unconditional love and support during all my studies.

Lastly, I would like to thank Shashi view primary school for allowing me to use their facility and granting me access to the information that I needed for this project to be a success.

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## **ABSTRACT**

**Background:** It is approximated that about nineteen million children in the world who are 15 years and below have visually impairment with twelve million of this value being due to uncorrected refractive errors. Amblyopia can arise if children are left with uncorrected refractive errors; it also causes limitation in academic progress, poor functioning of social life and diminished quality of life. Identification and correction of refractive errors at such an early stage can enhance the quality of life of the children and also improve their academic performance. With current clinical and economic impact of uncorrected refractive errors, studies from many practice settings will enhance knowledge on uncorrected refractive errors and the related matters.

**Aim:** The study looked for the pattern and distribution of refractive errors among primary school children in Bindura town.

**Methods:** The study used a cross-sectional design which was conducted at Shashi primary school. The study instruments which were used are a snellen chart, tumbling E chart, an auto refractor, a PD rule and an ophthalmoscope. A total number of 752 pupils were selected and from the auto refractor, the refractive errors were determined. The pattern and distribution was established from the results.

**Results:** the total number of participants was 752 students from Shashi view primary school in Bindura. Ages of the students ranged from 5 to 13 years, 364 (48.4%) were males while 388 (51.6%). The students were divided into two groups; one consisted of children aged from 5 to 8 years and the other from 9 to 13 years. The first group consisted of 379 (50.4%) and the second of 373 (49.6%). A total of 96.9% children had normal vision with no error. The overall prevalence of refractive error was 3.1%, with myopia constituting 73.9% and hypermetropia 26.1%. Prevalence of myopia was higher among females (56.5%). The spherical equivalence of astigmatism was used.



# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 Introduction**

This chapter portrays the study of refractive errors among primary school children in Bindura town. It gives the background of the research and the importance of it. It explains why the researcher chose to do this study and what motivated her to do it. It shows the study's importance to optometry and community as a whole.

### **1.2 Background of the study**

With current estimates there is about 2.2 billion people in the world living with visual impairment (World Health Organization, 2019). Eye disorders and visual impairment are mostly found in developing countries (World Health Organization, 2019). It is approximated that nearly 253 million people in the world are living with visual impairment, with 36 million of this number being blind whilst 217 million have low vision. Global reviews shows that uncorrected refractive error is the most causing factor of visual impairment and also being responsible for 18% of cases of blindness in the world (Balasopoulou et al., 2017). Approximately nineteen million children have some form of visual impairment globally with twelve million of these having uncorrected refractive errors (Military et al., 2019). This therefore, shows that uncorrected refractive errors are responsible for about two thirds of cases of visual impairment worldwide (Balasopoulou et al., 2017). Vision empowers unlimited access educational activities like studying and writing which are essential for educational achievement from early childhood growth up to adulthood (World Health Organization, 2019). Uncorrected refractive errors are the main causes of visual impairment in the world (World Health Organization Africa, 2020). As shown by the estimated 26.3 million people

living in Africa who are visually impaired, visual impairment is a serious health matter in the African continent(World Health Organization Africa, 2020).

Uncorrected refractive error has indicative economic significance concerning possible lost productivity in all countries (Shakeel, 2016). This issue of lost economic productivity may differ with the type of error (Shakeel, 2016). Hence the knowledge of pattern of refractive errors in primary school children will assist in public health strategy planning (Shakeel, 2016). Refractive errors are commonly present in the children and continue to the adulthood (Bharati, 2019). Undetected and uncorrected refractive errors are specially an indicative concern in primary school children (Bharati, 2019). As children are not old enough to identify the problem at an early stage or the parents have no idea on the slowly developing vision problem, uncorrected refractive error can have a grave impression on the learning process and educational capability (Bharati, 2019). This study will focus on the pattern and distribution of refractive errors in primary school children.

### **1.3 Problem statement**

Vision plays a significant task in the growth of a child's learning and communication ability. Visual impairment from refractive errors is the major problem in children and is the second causing problem of treatable blindness (Latif et al., 2014). Eye disorders are the fourth major disability in children and the main cause of handicapping conditions in children (Balasopoulou et al., 2017). Visual impairment caused by refractive errors can have instant and life-long effects in people, such as lost educational and career chances, lost personal economic benefits and diminished quality of life (Shakeel, 2016). Many elements are accounted for uncorrected refractive errors which are lack knowledge and acknowledgement of the error at individual family, society and public health level, unavailable services and being unable to pay for the refractive services and insufficient supply of low-cost corrective lenses (WHO, 1993).

Myopia is said to be the major refractive error in children (Military et al., 2019). Myopia in children should be diagnosed and proper management must be administered as early as possible before it progresses and cause adverse ocular effects (Military et al., 2019). Hypermetropia in children should also be cured because it causes asthenopic symptoms which worse with reading and doing close work (Military et al., 2019). Anisometropia must also be managed to prevent the possibility of developing amblyopia (Military et al., 2019). Issuing of glasses to correct the refractive error is considered to be one of the most effective treatments available. Since refractive errors can be corrected with corrective lenses then the number and their pattern should be found and corrected to avoid blindness and enhance the quality of life (Military et al., 2019). The intention of this study is to identify the prevalence of refractive errors, point out their types and to raise awareness amongst parents, teachers and primary health care workers.

This study will be done in Bindura to identify the common refractive errors that affect primary school children, since no study has ever been done to find the refractive status of children in school in this district. This study aims to raise awareness about refractive errors and also identify the common refractive errors that affect children.

#### **1.4 Aim of the study**

- To determine the pattern and distribution of refractive errors among primary school children in Bindura town.

#### **1.5 Objectives**

- To find the prevalence of refractive errors in primary school children.
- **To assess the pattern and distribution of refractive errors among school children in Bindura town.**

- To identify the association between refractive error with age and sex.

### **1.6 Significance of the study**

The results of this study may have clinical importance in Zimbabwe since little research has been done to assess the refractive errors among primary school children. The results of this study will add to the current body of knowledge in the field of optometry in Zimbabwe. This study will help identify the common refractive errors that affect primary school children in Bindura town. The detection of uncorrected refractive errors will help in raising awareness about them. Conducting this research will help in providing the estimated values of the pattern and distribution of refractive errors among primary school children in Bindura, which will help future studies.

## **CHAPTER 2**

### **LITERITURE REVIEW**

## **2.1 Introduction**

This chapter emphasizes on the broad literature review of the studies that have been done in relation to refractive status of the eye among school children. This chapter will constitute the global review, African regional review and lastly the Zimbabwean review. The sources used in this chapter included journal and articles obtained from World Health Organisation, Pub Med, Google Scholar and many others. Important search terms used to search for journals were refractive error, school children, pattern and distribution of refractive errors. The studies used in this review date between 2000 and 2022.

### **Global review**

This section focuses on studies done in other continents except Africa. It includes the researches that were done, participants involved and the results that were found. According to Omar et al. (2019), participation of 5–15 years old gives the most effective results and it is a low-cost strategy (Omar et al., 2019). Hence screening of the primary school children is a significant plan to know the prevalence of refractive error and the possible correction at the right time.

Wadaani et al (2013) selected 2246 Saudi primary school children with ages ranging from 6 to 14 years using multistage sampling method. The study was conducted in 30 different primary schools from three separate areas of Al Hassa, Saudi Arabia (Al Wadaani et al., 2013). Mainly three tests were done for eye screenings which are visual acuity assessment, evaluation of ocular motility and cover-uncover test. Children were referred for advanced examination including objective refraction using streak retinoscopy if they were found with defective vision (Al Wadaani et al., 2013). Of the screened children which were 2002 in number, the general prevalence of refractive errors was 13.7%, which was more prominent in females and students who live in rural areas (Al Wadaani et al., 2013). Refractive errors were commonly found in the 12 to 14 years age group. Only 9.4% of the children were found already wearing glasses for correction. The major causing refractive error was myopia in all sexes.

Norouzirad et al (2015) carried out a study on school children to find the prevalence of refractive errors in Dezful, Iran. Refractive error examinations were done for 1130 children, the results found were used for analysis. The children's age ranged from 6 to 15 years, 520 were female. The prevalence of myopia was found to be 14.9%; with 17.0% in boys and 12.3% in girls (Norouzirad et al., 2015). The study showed higher myopia in boys. The study also showed myopia increased as age increases from 7.1% in the smaller children of 6 to 7 year old age group to 22.6% in the older children of 14 to 15 year old age group (Norouzirad et al., 2015). Hypermetropia was found in 12.9% of the studied students and was higher amongst girls and in older children whilst stigmatism was found to be higher in boys (Norouzirad et al., 2015).

Pi et al (2010) randomly selected 3469 children aged 6 to 15 years in western China to determine their refractive status. Of the 3469 children only 3070 met the criteria of the study which were 1611 boys and 1459 girls. Among the 3070 children, 384 had hypermetropia, 422 had myopia 343 had astigmatism (Pi et al., 2010). These results illustrated that age affected the prevalence of hypermetropia and Myopia, with that of hypermetropia decreasing as it increases and that of myopia increasing. Prevalence of astigmatism was not affected with age (Pi et al., 2010). The study presented that gender had no influence on the prevalence of hypermetropia myopia, and astigmatism although it was slightly high in girls (Pi et al., 2010). A study was conducted by Maduka et al (2021) in the south-eastern region of Nigeria, 5723 children participated in the study consisting of 2686 boys and 3037 girls aged 5 to 15 years (Ezegwui et al., 2021). The prevalence in this research was 2.1% in all age groups and gender. Most of the refractive errors were due to myopia occurring more in the females and children in 7th grade. This was lower than the 16.2% reported in China.

One hundred and ten children from Orang Asli in Negeri Sembilan, Malaysia were chosen to investigate the refractive status among school children (Omar et al., 2019). The tests performed on

the children included visual acuity test, cover test, ocular external assessment and ophthalmoscopy. Refractive errors were found in thirty eight children with 31 having hypermetropia (Omar et al., 2019). Six children were found with myopia and it was more in girls. This is in contradiction with other surveys done in Asia, in which myopia was the most found refractive error.

Sarma and Krishnatrey (2016) conducted a survey in India on refractive errors among the school children. Five schools were randomly picked and 400 children were selected all aged between 6 and 15 years (Sarma & Krishnatreya, 2016). The results showed that 94 children out of 400 had refractive errors with 86 being myopic (Sarma & Krishnatreya, 2016). The results showed that myopia was the most found error then astigmatism and hypermetropia (Sarma & Krishnatreya, 2016). Out of the children with refractive errors 23 were wearing prescription glasses (Sarma & Krishnatreya, 2016).

A study to evaluate the pattern and prevalence of refractive errors in school children was done in Maner, Patna Bihar, India (Bharati, 2019). A number of 252 children with ages ranging from 11yr to 16 years, 154 were boys and 98 were girls participated in the study. The students mostly complained of eye pain, watering eyes whilst reading or watching TV/mobile, headache while reading, not seeing blackboard clearly, difficulty in reading books and difficulty seeing at night (Bharati, 2019). A number of 46 children had refractive errors (Bharati, 2019). The distribution of refractive errors in the 14 to 16 years age group was higher than in the 11 to 13 years age group (Bharati, 2019). Overall prevalence was found to be more in girls.

Military et al (2019) did a survey on prevalence and pattern of refractive errors in school children in Mangla, Pakistan. A total of 2491 children participated in which 1250 were boys and 1241 were girls (Military et al., 2019). The study showed that only 235 children were found with refractive errors; 109 boys and 126 girls (Military et al., 2019). The 10 years and above group had a higher

number of refractive errors than the 10 years and below group. Myopia was mostly found in the 10 years and above group and in the 10 years and below group simple astigmatism was major refractive error (Military et al., 2019). In the whole study, myopia contributed 42.2% of the total refractive error found in the survey, simple astigmatism contributing 11.9% and hypermetropia made up 8.9% and was mostly found in 10 years and above age group (Military et al., 2019). Myopia was the major refractive error in all sexes.

In another study done in India, 642 pupils aged from 5 to 16 years of age participated in the study, 340 were boys and 302 were girls (Hashia & Slathia, 2017). Refractive errors were found in 75 students, 42 being boys and 33 being girls. The prevalence in the 5 to 7 years age group was 3.8% and 17.6% in the 14 to 16 years group (Hashia & Slathia, 2017). Myopia was found in 28 pupils, hypermetropia in 6 and astigmatism in 41. Myopia was mostly common in the older pupils and both hypermetropia and astigmatism in younger pupils (Hashia & Slathia, 2017). Myopia and hypermetropia were the major refractive errors in boys whilst astigmatism was common in girls (Hashia & Slathia, 2017). The studies review that myopia is the major cause of refractive errors in school-aged children.

### **African review**

This section focuses on studies done in Africa. The literature reviews will be classified according to regions of Africa. The regions that will be explored are North Africa, East Africa, West Africa and lastly Southern African region.

### **North African review**

Abah et al (2011) conducted a study in Zaria, Nigeria to assess ocular disorders in school children. The study was done on 327 pupils, who were aged from 5 to 17 years, boys were 149 and girls were 178 (Abah et al., 2011). Of all the pupils 324 had an unaided visual acuity between 6/4 and 6/18 and 3 had visual acuity between 6/24 and 6/60 (Abah et al., 2011). The prevalence of ocular



disorders was 22.6% in this survey (Abah et al., 2011). The major disorder was uncorrected refractive error. The children found with uncorrected errors were 26 with hypermetropia leading.

In another study done in Nigeria to find out the visual impairment in primary school children, 1020 primary school students who were aged from 5 to 15 years were chosen but 998 took part in the study (Vision & Health, 2018). The participants comprised of 443 boys and 555 girls. Out of 998 students tested 901 had some form of refractive error (Vision & Health, 2018). The retinoscopy and auto-refraction results showed that hypermetropia was more common in younger children and myopia older children (Vision & Health, 2018). The results indicated 97 children had refractive errors with 45 being myopic, 35 astigmatic and 17 hypermetropic (Vision & Health, 2018). Forty-two children with refractive errors were males and 55 were females. (Vision & Health, 2018).

### **East African review**

Wedner et al (2002) carried out a study to find the prevalence of myopia in secondary school students in Tanzania. Eye screening was done for 2511 students aged from 14 to 19 years (Wedner et al., 2002). Of all the students examined 174 had a visual acuity not better than 6/12 in one or both eyes (Wedner et al., 2002). The major cause for diminished eyesight was refractive error with a prevalence of 6.1% (Wedner et al., 2002). Most of the students were myopic and astigmatism was found in 49 of the 141 myopic students (Wedner et al., 2002). Hypermetropia and astigmatism alone were both rare.

Muma et al (2019) did a study on pattern of refractive errors in public high school students in Nairobi. In the 11 schools selected for this study, 1390 of 1622 students identified from the class register as eligible for the study were recruited, 751 were males and 639 were females (Code-, 2019). A visual acuity of 6/12 and worse was found in 247 students. Ten students were found to have other visual problems while 209 had a refractive error (Code-, 2019). Among the 247 students with impaired visual acuity, 84.6% had a refractive error making it the most common cause. The mean age of the 209 students with refractive error was 17 years; this included 95 males and 114 females (Code-, 2019). All three types of refractive errors were found among students in this study, including 194 with myopia, 103 with astigmatism and 10 with hypermetropia. Myopia was more prevalent among girls compared to boys. Nine students had pure astigmatism while the other 94 had coexisting myopia or hypermetropia (Code-, 2019).

A study done by Muma et al (2009) in Kenya with 1522 primary school students, 852 were females and 587 were males (Muma et al., 2009). Reduced visual acuity considered to be worse than 6/18 was present in 81 pupils (Muma et al., 2009). The major cause of reduced visual acuity was refractive error which was present in 75 pupils (5.2%). Myopia was present in 24 pupils, higher in the ages 14 to 15 years and was similar between males and females. The 12 to 13 years age group was more twice likely to be hypermetropic than the 14 to 15 years age group. In this study, hypermetropia was found more prevalent than myopia unlike what has been reported in other studies. In this study astigmatism was found in 4 pupils, 3 being females and 1 male student.

### **West African review**

Omuemu et al (2010) did study on school children aged from 5 to 19 years in the Cape Coast Municipality, Ghana. A number of 1103 pupils were chosen to take part in the survey in which

957 children were screened, 660 were females and 297 were males (Ovenseri-Ogbomo & Dr V Omuemu, 2010). Subjective and objective refractions were done for all the pupils screened. The results showed that 245 children had refractive errors, this consisted of 44 being hypermetropic, 66 myopic and 135 astigmatic (Ovenseri-Ogbomo & Dr V Omuemu, 2010). It also showed that hypermetropia was mostly found among children aged 5 to 7 years, while myopia was mostly found in the 17–19 years age group (Ovenseri-Ogbomo & Dr V Omuemu, 2010). All the errors were not diagnosed or corrected.

In another study done in Ghana by Nakua et al (2015), to investigate the prevalence of refractive errors among junior high school students. A number of 540 students were selected to take part in the study. Among the students selected only 504 were examined (Nakua et al., 2015). Out of the students examined 38 had refractive errors, 15 with astigmatism, 12 with hypermetropia and 11 with myopia (Nakua et al., 2015). Myopia was most found in children from the urban areas than from the rural areas whereas hypermetropia was more prevalent in the rural residents. Generally, all refractive errors were mostly found among females, urban and older students (Nakua et al., 2015).

### **Southern Africa review**

Vision and Health (2020) conducted a study on visual impairment in school-going children aged 6 to 18 years in South Africa. A sample size of 377 students was selected to participate in the study with 165 female and 161 male (Vision & Health, n.d.). Refractive findings were achieved with an auto refractor in 326 students who took part in this study (Vision & Health, n.d.). The prevalence of refractive error was 20.6%, being more in the 14 to 18 years group and myopia being the commonest (Vision & Health, n.d.). Difference in the prevalence of refractive error between girls and boys was insignificant. Myopia was more in males and older children (Vision & Health, n.d.).

The prevalence of hypermetropia was 2.8% of the overall sample; it was more prevalent at ages 14 to 18 years and in females (Vision & Health, n.d.). Astigmatism prevalence in the sample was 7.4% and was mostly observed in the 10 to 13 year age group (Vision & Health, n.d.).

Wajuihain (2017) conducted another survey to in South Africa. The sample comprised of 1586 children, 632 males and 954 females with ages ranging from 13 to 18 years (Wajuihian, 2017). The visual tests performed were visual acuity, refractive error evaluation with an auto refractor and subjective refraction. Overall the patients were mostly myopic. The prevalence estimates for the refractive errors were myopia which was 7%, hypermetropia 5%, astigmatism 3% and anisometropia 3% (Wajuihian, 2017). The relationship between refractive error and gender, age, and grade levels was insignificant.

Tagoh et al (2020) carried out a research on visual impairment amongst rural residents in Mashonaland central province, Zimbabwe, with 519 participants aged from 5 to 100 years (Tagoh et al., 2020). Of all the 519 people, 233 were males and 286 were females. The prevalence was 56.8% and blindness was 13.1%, with uncorrected refractive errors (54.2%) and cataract (24.8%) being the major causes. Hypermetropia was found to be the major refractive error (Tagoh et al., 2020).



## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1 Introduction**

This chapter elaborates how the research was done to find the refractive errors among primary school children in Bindura. It comprises of the study setting, design, and inclusion and exclusion criteria, instruments used to collect data, data collection and analysis methods that were incorporated. It also consist the ethical approval that was needed to conduct the research.

#### **3.2 Study setting**

The research was done at Shashi view primary school which is in Bindura town which is about 87 km North-East of Harare, the capital city of Zimbabwe (Helliker & Bhatasara, 2018).

#### **3.3 Study design**

The survey used a descriptive cross sectional study design, which is a type of observational research that analyzes the outcome and exposures of data collected at one point in time across a population like in this study, school children were examined at a point in time (Setia, 2018).

#### **3.4 Study period**

The survey was done from April 2022 to November 2022.

#### **3.5 Study population**

The study population included students from Shashi view primary school.

### **3.6 Inclusion criteria**

- Primary school students at Shashi view primary school.
- Students with parents who agreed to have their children take part in the study.

### **3.8 Exclusion criteria**

- Students with parents who gave consent to have their child participate in the study.
- Students who did not come to school on the day of examination.

### **3.9 Study instrument**

The instruments used were a xyz ophthalmoscope from Chongqing Vision Star Optical Co Ltd, auto refractometer from CANTON optics, Snellen chart and a PD rule.

### **3.10 Data collection**

Data was accumulated using a questionnaire with two sections, the first part was used to collect the students' demographic information, and the second part of the questionnaire was for recording the autorefractometer results and the refractive error was determined by the researcher. The last part was for recording funduscopy results.

### **3.12 Data analyses**

Data gathered from the students was examined using IBM Statistical Package for Social Sciences (SPSS) version 21. The data was entered into SPSS and grouped to show frequencies and percentages computed. A Chi-square test was done to find the relationship between refractive error and other variables such as age and gender.

### **3.13 Ethical consideration**

Ethical approval letter was given by the Bindura University of Science Education Ethics Committee, with approval number 0019/2022. Ethical considerations were observed during the study to avoid any harm on the participants and reduce the spread of Covid-19 the workspace and instruments were sanitised regularly. The students took home informed parental consent forms for the parents to sign them if they agree to have their children take part n the research. The students were also given informed assent form with understandable description of the research. Participation in the study was not mandatory and participants were free to quit at any point. Confidentiality was maintained throughout the study. The research did not use anyone's' real name or identity in order to maintain privacy.



## **CHAPTER 4**

### **RESULTS**

#### **4.1 Introduction**

This chapter gives a report on the results of the study on the pattern and distribution of refractive errors among primary school children in Bindura town. Results from the study include the frequency and relationship between age, gender, grade, place of origin and refractive error. The results from the study are displayed in form of graphs and tables. The tables show the distribution of participants according to age, gender, grade and place of origin.

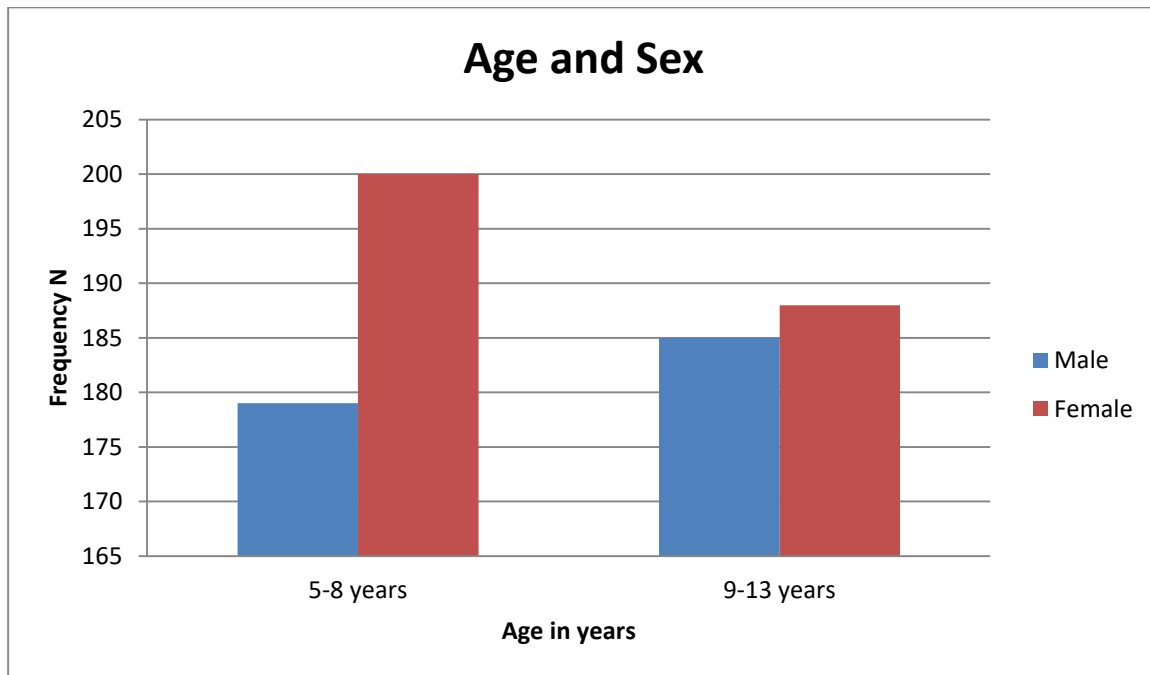
#### **4.2 Demographic characteristics**

The number of students who took part in this study was 752 primary school students from Shashi primary school. There were 388 (51.6 %) female students and 364 (48.4 %) male students, and their ages from 5 to 13 years old. The students were split into two ranges according to age groups, the first comprised of 5-8 years and the other 9-13 years old. There were more female participants in all age groups. The highest number of females (200) was found in the 5-8 whereas the highest number of males was found in the 9-13 age groups. The 5-8 and 9-13 years age groups had almost the same number of participants resulting in 50.4% and 49.6% of the sample, respectively.

*Table 1 Distribution of participants according to age, sex, grade and place of origin*

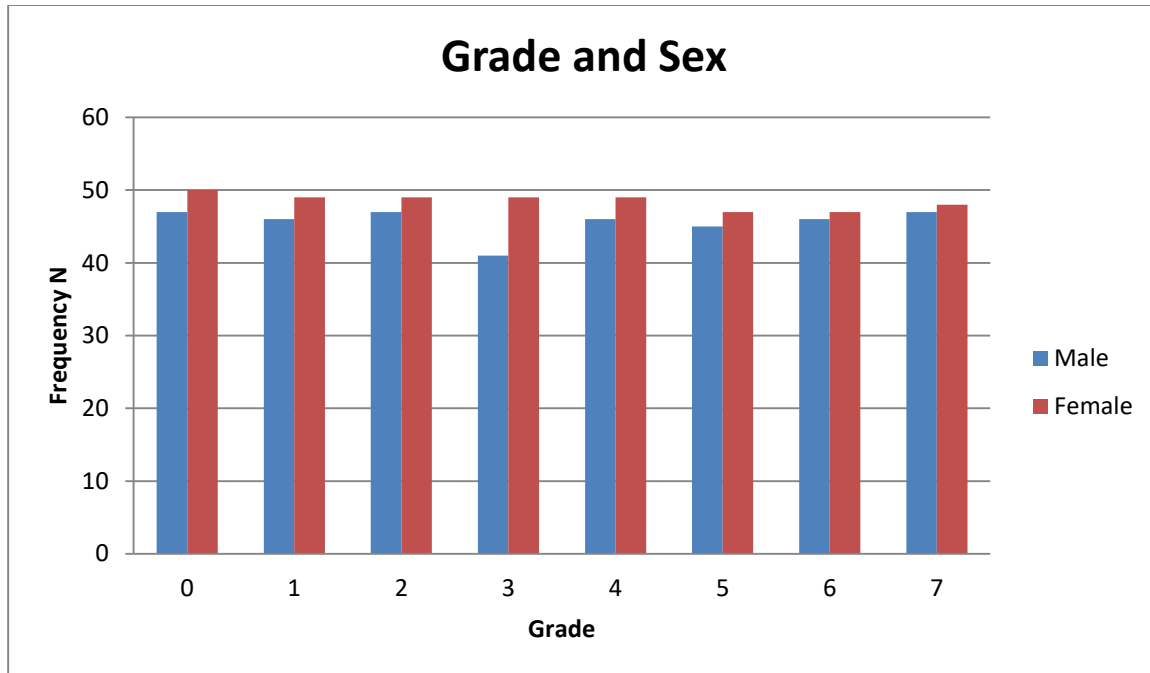
Variables		Sex		Total (%)	P values
		Male	Female		
Age group (years)	5-8	179	200	379 (50.4)	0.516
	9-13	185	188	373 (49.6)	
Place of origin	Rural	272	286	558 (74.2)	0.886
	Peri-urban	61	65	126 (16.8)	
	Urban	31	37	68 (9)	
Grade	ECD	47	50	97 (12.9)	1.000
	1	46	49	95 (12.6)	
	2	47	49	96 (12.8)	
	3	41	49	90 (12)	
	4	46	49	95 (12.6)	
	5	45	4	92 (12.2)	
	6	46	47	92 (12.2)	
	7	47	48	95 (12.6)	
<b>TOTAL</b>		364 (48.4)	388 (51.6)	752 (100)	

Figure 1 Distribution of participants according to age and sex



### 4.3 Distribution of participants in grade and gender

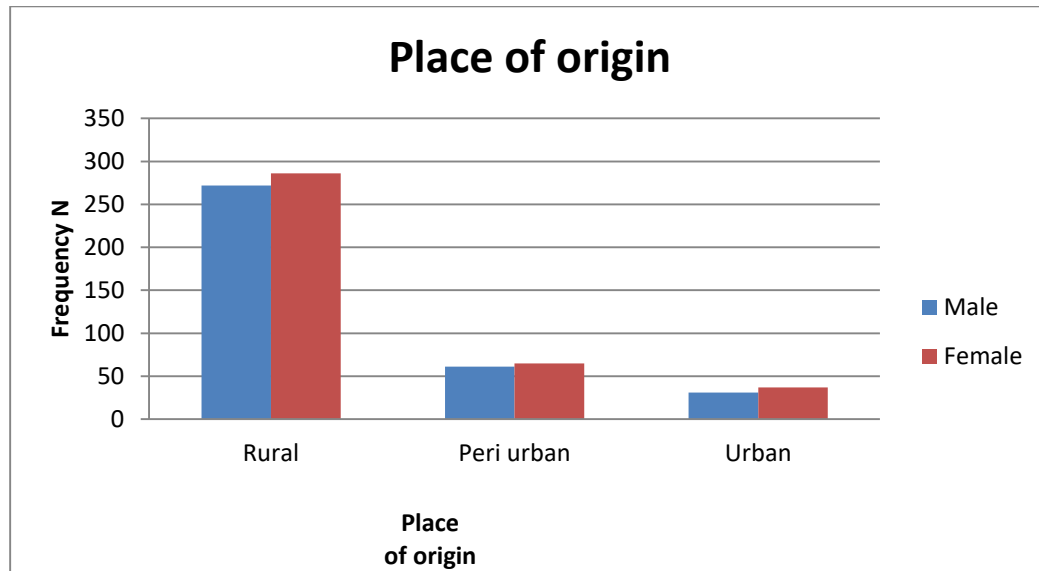
Figure 2 Distribution of participants according to grade and sex



From Table 1 and Figure 2 above all grades had almost the same number of participants. Grade 3 had the least number of participants with 90 students accumulating a 12 % of the sample. The ECD had the highest number of participants with 97 students resulting in 12.9 % of the sample. There were more female participants in all grades; the grade 0 had the highest number of female students.

#### **4.4 Distribution of participants according to place of origin and gender**

*Figure 3 Distribution of participants according to place of origin and sex*

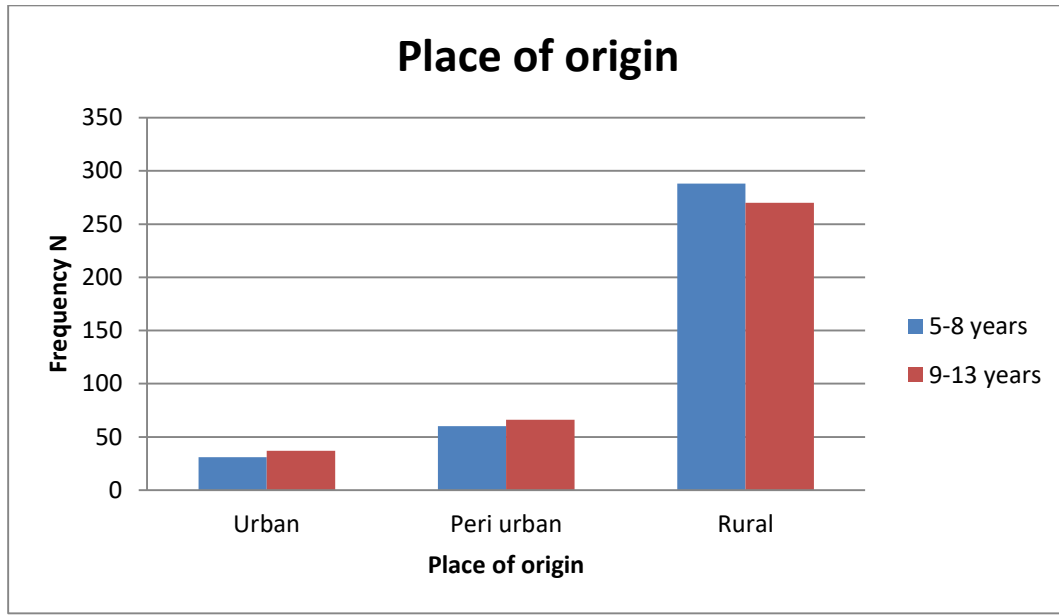


According to Table 1 and Figure 3 most students came from rural areas (74.2%) followed by peri-urban and then lastly urban areas.

#### **4.5 Age group and place of origin**

From Table 1 and Figure 4, most students from all age groups came from rural backgrounds, in which most of them are from the 5-8 years age group.

Figure 4 Distribution of participants according to place of origin and age



#### **4.6 Distribution of Visual Acuity according to gender and age group**

The visual acuities ranged from 6/6 to 6/48; there was no child who presented with a visual acuity of 6/60 or worse. As shown by the table below most participants presented with visual acuity of 6/6 and 6/9 (97.8 %) in both eyes which is normal, most of them were females (49.6%). More males than females (1.3%) presented with a visual acuity of 6/12 or worse in both eyes. One male student had a visual acuity of 6/48 in both eyes. No association between visual acuity and gender was found ( $\chi^2 = 4.624$ ,  $df = 5$  and  $p = 0.463$ ). Most of the students in all age groups (97.8%) could read up to the 6/6 or 6/9 line on the visual acuity chart in both eyes in all age groups. As shown by Table 2, there were more students from the 5-8 years age group who presented with a visual acuity of 6/12 (1.6%) or worse. Only one student from the 9-13 years age group had a visual acuity of 6/48 in both eyes. No relationship was found between visual acuity and age group ( $\chi^2 = 8.581$ ,  $df = 5$  and  $p = 0.127$ )

*Table 2 Distribution of visual acuity according to sex and age groups*

Visual acuity (OU)	Sex		Age group (years)		Total (%)
	Male (%)	Female (%)	5 - 8	9 - 13	
6/6	351 (46.7)	373 (49.6)	724 (96.3)	364 (48.4)	360(47.9)
6/9	3 (0.4)	8 (1.1)	11 (1.5)	3 (0.4)	8 (1.5)
6/12	5 (0.7)	4 (0.5)	9 (1.2)	6 (0.8)	3 (1.2)
6/18	3 (0.4)	1 (0.1)	4 (0.5)	4 (0.5)	0 (0.5)
6/24	1 (0.1)	2 (0.3)	3 (0.4)	2 (0.3)	1 (0.4)
6/48	1 (0.1)	0 (0)	1 (0.1)	0 (0)	1 (0.1)
Total	364 (48.4)	388 (51.6)	752 (100)	379 (50.4)	373 (49.6)

#### **4.7 Pattern and distribution of refractive error according to gender**

Myopia was recorded from -0.50 DS and above and hypermetropia was classified from +2.00 DS and above, the spherical equivalence of astigmatism was recorded as either of the two. Myopia was found mostly in females (1.5%) than males (0.8%). There were few students (0.8%) who were found with hypermetropia in which most of them were males (0.5%). The results presented no association between refractive error and age group (chi = 1.978, df = 2 and p = 0.372).

*Table 3 Distribution of refractive errors according to sex and age groups*

Age group (years)	Sex
-------------------	-----

Refractive Error	5 – 8	9 – 13	Male	Female	Total (%)
Emmetropia	366 (48.7)	363 (48.3)	354 (47.1)	375 (49.9)	729 (96.9)
Myopia	8 (1.1)	9 (1.2)	6 (0.8)	11 (1.5)	17 (2.3)
Hypermetropia	5 (0.7)	1 (0.1)	4 (0.5)	2 (0.5)	6 (0.8)
Total	379 (50.4)	373 (49.6)	364 (48.4)	388 (51.6)	752 (100)

Figure 5 Distribution of refractive errors according to sex

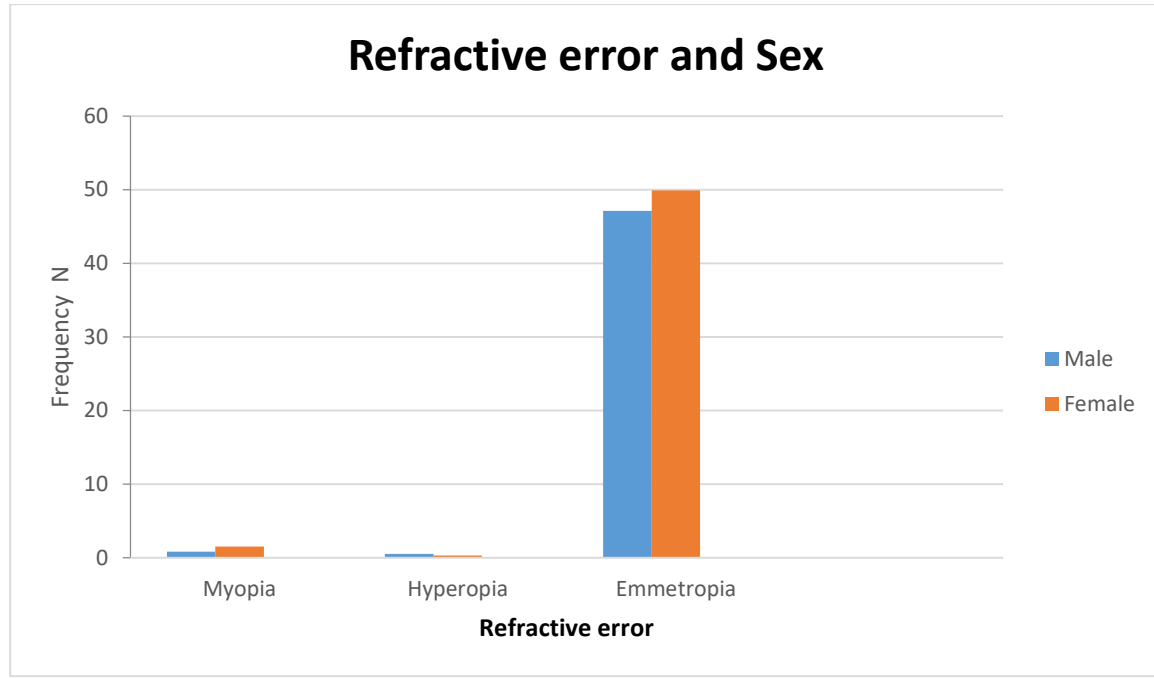
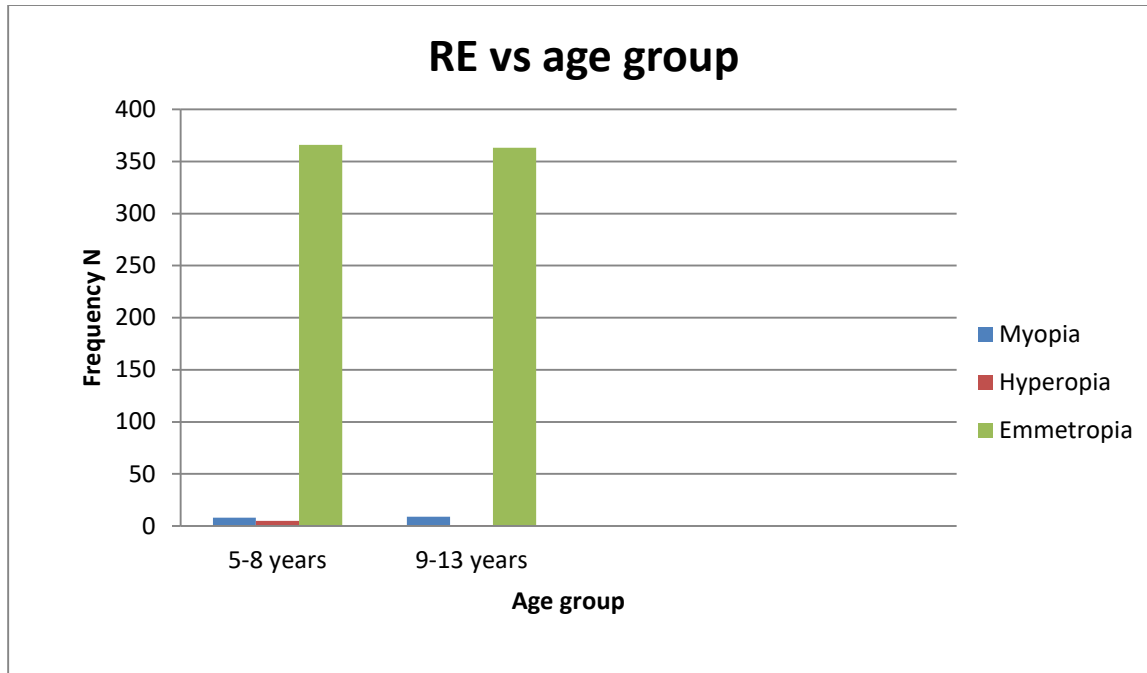


Table 7 and figure 5 above indicate that most participants (96.9%) were emmetropic with no refractive error.



#### 4.9 Distribution of refractive error according to age group

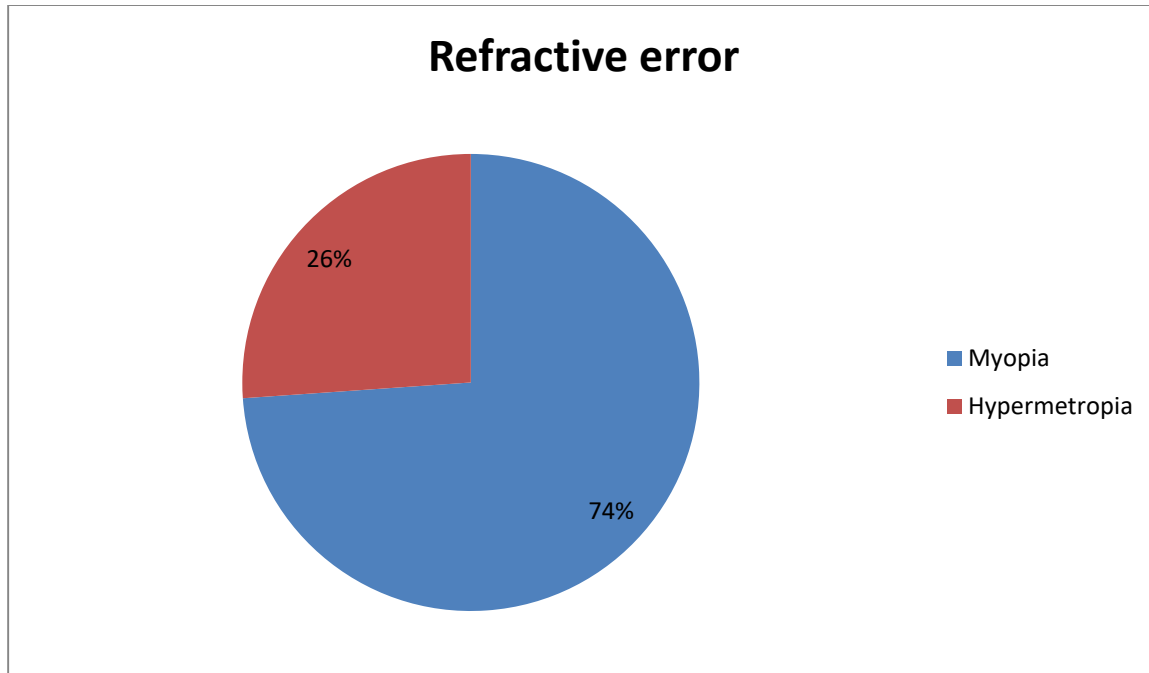
Figure 6 Distribution of refractive error according to age groups



Most children (96.9%) were emmetropic with no refractive error in all age groups. As shown by Table 2.3% of the participants had myopia and 0.8 % had hypermetropia. There were more children (1.8%) from the 5-8 years age group who had myopia or hypermetropia. The results from the study showed no association between age group and refractive error ( $\chi^2 = 2.69$ ,  $df = 1$ , and  $p = 0.516$ )

#### **4.10 Prevalence of refractive error.**

*Figure 7 Prevalence of refractive errors*



The prevalence of refractive errors was 3.1%. Myopia made up most of the refractive errors as shown by figure 7 above.

#### **4.11 Conclusion**

This chapter showed the results that were found from the study. The prevalence of refractive error was 3.1% which was mainly myopia and more frequent in female students.

## **CHAPTER 5**

### **DISCUSSION**

#### **5.1 Introduction**

This chapter examines the results obtained from the study in connection to the literature and draws a conclusion in relation to the study aims and objectives which were to find the pattern and distribution of refractive errors among primary school children in Bindura town.

#### **5.2 Prevalence of refractive errors**

The prevalence in this study was found to be 3.1 %. Studies conducted in Asia found very high prevalence's which ranged from 6.6% to 34.5% which are higher when compared to the 3.1% recorded in this study (Al Wadaani et al., 2013; Bharati, 2019; Hashia & Slathia, 2017; Military et al., 2019; Norouzirad et al., 2015; Omar et al., 2015; Sarma & Krishnatreya, 2016; Shakeel, 2016). These differences noted in Asia from this study might be because of differences in demographic factors, socioeconomic factors and different races.

Researches done in the northern African region found low prevalence's in school children than what was found in the Asian countries. One study in Nigeria recorded a prevalence of 8% which was higher than what was found in this study, the most recent study recorded a prevalence of 2.1% which was low than what was found in this study, this might be due to increase in awareness and correction of refractive errors in Nigeria (Abah et al., 2011; Maduka- et al., 2021). Studies done in Ethiopia had slightly high findings of 6.3% and 7.6% which is similar to some studies in Asia (Mehari, et al., 2013; Kassa, et al., 2010). These high prevalence's found in North Africa might be due to large study populations included in their studies.

In the East African region the prevalence's recorded were slightly higher than what was found in this study. Tanzania and Kenya recorded a prevalence of 6.1% and 5.2% respectively, this is similar to what was found in Ethiopia (Muma et al., 2009; Wedner et al., 2002). Overall, the prevalence of refractive errors in children according to this study is slightly high. In West Africa, 3.5% of the children involved in a research study had refractive errors which is relatable to the 3.1% which was found in this study (Abu et al., 2015). In another study done in Ghana a prevalence of 7.5% was recorded which is relatable to the 7.5% found in Ethiopia and the 6.1% found in Tanzania (Nakua et al., 2015). A high prevalence was also found in Ghana which was 25.6% which is similar to the 23.5% in India (Ovenseri-Ogbomo & Dr V Omuemu, 2010). In South Africa 12.3 % was found in school children, this is high than what was recorded in most parts of Africa (Vision & Health, n.d.). These differences noted in this cross sectional study and other studies might be due to different in age groups, measurement methods and definitions of refractive.

### **5.3 Types of refractive errors present**

In this cross sectional study, myopia was the main cause of refractive error contributing 73.9%, which is consistent with literature concerning educational exposure as a risk factor for myopia in many parts of the world. Among the Asian community, Saudi Arabia, Pakistan and India, myopia was found to be the leading error with prevalence's of 65.7%, 42.2%, 81.9% and 31.1% of the screened errors respectively among school going children (Al Wadaani et al., 2013; Military et al., 2019; Sarma & Krishnatreya, 2016). Australia also found myopia to be the major cause of refractive error accumulating 56.4% (Gao et al., 2012) Other studies in India found myopia to be the second main cause with astigmatism being the major cause (54.8% and 54.3%) (Hashia & Slathia, 2017; Shakeel, 2016). One study conducted in Malaysia found hypermetropia to be the most prevalent with 68.9% of the children with refractive errors having it (Omar et al., 2019). In Europe two studies done in Northern Ireland reported myopia (27.1% and 39%) to be the second

leading cause of refractive error with hypermetropia being the major cause (37.8% and 61%) (Donoghue et al., 2011; Harrington et al., 2020). The prevalence of hypermetropia in this study was very low with a percentage of 26.1% as compared to what was found in Malaysia and in Europe.

In northern African region studies done found myopia to be the most prevalent. Its prevalence was highest in a study done Ethiopia (98%) followed by 53.6% and 65.9% reported in studies done in Nigeria (Chuka-Okosa, n.d.; Olusanya et al., 2019; Tibebu Kassa, 2000). Findings from these studies reported myopia to be the major cause of refractive error which is also similar to this study as myopia constituted 73.9% of the refractive errors. In East Africa, Tanzania recorded myopia to be the most prevalent refractive error with 91.6%, whilst in Uganda astigmatism was the leading error with 52% (Kawuma & Mayeku, 2002; Wedner et al., 2002). In West Africa two studies conducted in Ghana found hypermetropia (39.5%), which was high than the 26.1% in this study and astigmatism (54.9%) to be the most prevalent refractive errors (Nakua et al., 2015; Ovenseri-Ogbomo & Dr V Omuemu, 2010). In south Africa myopia was the main refractive error with 50.7% and which was less than what was found in this study (Wajuihian, 2017). Kenya recorded hypermetropia (62.7%) being the major refractive error which was higher than the 39.5% found in Ghana (Muma et al., 2009).

#### **5.4 Pattern and distribution of refractive error according to gender**

There were more girls (388) than boys (364) in this study, might be due to the fact that there are more females than males in Bindura according to the census done this year. Myopia and hypermetropia were more common in girls than in boys as shown by Table 3 of this study, however, these findings were statistically insignificant as ( $p > 0.05$ ). Similar studies done in Asia also found refractive errors to be more common in girls ranging from 51.2% to 54.8%, this might be because girls grow up faster and reach puberty earlier (Al Wadaani et al., 2013; Balasopoulou

et al., 2017; Military et al., 2019; Norouzirad et al., 2015). In India 56% of the students with refractive errors were boys, which was mainly hypermetropia and this is contrary to most studies (Hashia & Slathia, 2017).

In North Africa most studies conducted indicated that more females were found to have refractive errors than males. In Ethiopia (53.5%) and Nigeria (53.8%) females had refractive errors which is relatable to what was found in this study (Abah et al., 2011; Tibebe Kassa, 2000). In another study done in Ethiopia male students (51.7%) were to have more refractive error than female students, this is similar to the 56% found by Hashia (2017) in India (Hashia & Slathia, 2017; Mehari & Yimer, 2013). In East Africa, Kenya a similar trend concerning refractive errors and gender (Muma et al., 2009). In all these studies there was no statistical significance between refractive error and gender ( $p > 0.05$ ).

In Western African region, studies done in Ghana recorded 65.8%, 69% and 55% females with refractive error, this was more than what was found in this study and was statistically significant ( $p = 0.03$ ) (Abah et al., 2011; Nakua et al., 2015; Ovenseri-Ogbomo & Dr V Omuemu, 2010). African region, south Africa reported no significance distinction in the prevalence of refractive errors between males (50.7%) and females (49.3%) (Vision & Health, n.d.).

### **5.5 Pattern and distribution of refractive error according to age**

There were more pupils in the 5 – 8 years (56.5%) age group with refractive errors in this study. This is contrary to many studies that were done globally which recorded refractive errors increasing with age. Prevalence of myopia increased from 47.1 % in the 5 – 8 to 52.9% in the 9 – 13 years age group and that of hypermetropia decreased from 83.3% in the 5 – 8 to 16.7% in the 9 – 13 years age group. This is similar to what was found in India with myopia increasing with age

from 8.6% in the 5 to 7 to 42.7% in the 14 to 16 years age group and also hypermetropia decreasing from 52.3% in the 5 to 7 to 6.6% in the 12 to 14 years age group, in this study the increase was statistically significant (Hashia & Slathia, 2017). This trend was recorded in many countries which include Arabia, Iran, Pakistan, Malaysia and China with myopia increasing with age and hyperopia decreasing with age (Al Wadaani et al., 2013; Military et al., 2019; Norouzirad et al., 2015; Omar et al., 2019; Pi et al., 2010). Studies done in Australia and in Europe also indicated the same trend with refractive errors and age (Donoghue et al., 2011; Gao et al., 2012; Harrington et al., 2020).

Most studies done in North Africa indicated refractive errors being more frequent in the older children from 10 years and above which is contrary to what was found in this study. In studies done in Morocco, Ethiopia and Nigeria myopia increased in age and hypermetropia decreased with age which is evident in this study, in all these studies there was statistical significance between age and refractive error (Anera et al., 2009; Maduka- et al., 2021; Tibebe Kassa, 2000).

Similar results found in North Africa were also recorded in East and West Africa in Kenya, Tanzania, Uganda and Ghana with refractive errors being high among older students, myopia increasing with age and hypermetropia decreasing with age (Kawuma & Mayeku, 2002; Muma et al., 2009; Oveneri-Ogbomo & Dr V Omuemu, 2010; Wedner et al., 2002). Only in Tanzania, Ghana and Kenya was there statistical significance between age and refractive error, which is contrary to this study since the relationship between age and refractive error was insignificant. In South Africa refractive error increased with age but both myopia and hypermetropia increased with age which is different to what most studies in Africa found (Vision & Health, n.d.).

### **5.6 Limitations of the study**

The results of this cross sectional research study cannot be popularized to the whole town of Bindura, as the study was done at Shashi view primary school with small sample size. There was

lack of resources and funds to collect data from many primary schools in the town of Bindura. There was also lack of manpower since data collection was done with only one person.

### **Conclusion**

The prevalence of refractive errors in primary school children was 3.1%; there were more females 13 (56.5%) than males 10(43.3%). Myopia was the major refractive error. Children aged 5 to 7 years were found to have more refractive errors than older children. Eye screening and correction of refractive errors in children can help reduce this prevalence.

### **Recommendations**

Refractive error services should be made affordable to all. Education and awareness about refractive errors in children should be provided to the general public. Studies like this one should be done in Zimbabwe in schools in order to raise awareness and educate teachers and parents about refractive errors in children. The results of this study can be used by paediatricians, ophthalmologist, optometrist and all health professional workers.

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## LIST OF APENDICE

### APENDIX I: ETHICAL CLEARENCE



#### **RESEARCH ETHICS COMMITTEE**

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#### **BINDURA UNIVERSITY OF SCIENCE EDUCATION**

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25 July 2022

Dear Abigail Mbevi Masuka - B191329A

**RE: RESEARCH ETHICAL CLEARANCE: Pattern and distribution of refractive error among school-going children in Bindura**

Thank you for the application for review of Research Activity that you submitted to Bindura University of Science Education Research Ethics Committee (BUSEREC). Please be advised that your protocol has been reviewed and was approved.

This approval is based on the review and approval of the following documents that were submitted to BUSEREC for review:

1. Study protocol

Approval Number: **0019/2022** should be used on all correspondence, consent forms and documents as appropriate.

Type of Meeting	:	Expedited
Approval Date	:	26/07/2022
Expiry date	:	25/07/2023

After the expiry date, the project may only continue after renewal. For purposes of renewal, a progress report should be submitted three months before the expiry date for continuing review.

All serious problems to do with safety of participants must be reported within three (3) working days to BUSEREC. You are not expected to make any changes/adjustments to the protocol including the consent documents. Any trials involving drugs, devices and biologics require approval of the Medicines Control Authority of Zimbabwe before commencement.

Upon termination of the study, a report has to be submitted to BUSEREC.

---

Yours sincerely



.....  
S. Muyambo,  
BUSEREC CHAIRPERSON

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**FACULTY OF SCIENCE AND ENGINEERING  
DEPARTMENT OF OPTOMETRY**

6<sup>th</sup> July, 2022

TO WHOM IT MAY CONCERN

**PERMISSION TO CONDUCT PROJECT STUDY AT YOUR FACILITY**

This letter serves to confirm that **ABIGAIL MASUKA** is a bona fide student of the Bindura University of Science Education, Department of Optometry, currently enrolled in the 4th year Honours Degree program with a registration number 6191329A.

The research on the topic "*Pattern and distribution of refractive errors among primary school students in Bindura Town*".

Your institution is kindly requested to assist in granting sincere permission to undertake the research process. All information provided will be treated strictly as confidential and purely for academic purpose.

Looking forward to your favourable response.

Thank you.

Yours Sincerely

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**TEACHER IN CHARGE**  
**SHASHI VIEW PRIMARY SCHOOL**  
**31 OCT 2022**





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BINDURA UNIVERSITY OF SCIENCE EDUCATION

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**QUESTIONNAIRE**

**Title: Pattern and distribution of refractive errors among school children, Shashi primary school.**

**SECTION A**

Demographic Data

Date: / /

1. Age (in years) .....

2. Gender: Male:  Female:

**SECTION B**

Refractive status findings:

1. Autorefractometer findings:

Right eye	Left eye

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SECTION C

Ocular structure

Right eye

Left eye

Lids/lashes

Conjunctiva

Cornea

Pupil

Lens

Vitreous

Fundus

CD ratio

APENDIX IV: ASSENT FORM

My name is Abigail Masuka; I am a student at Bindura University of Science Education.

I am asking you to take part in this research study because I am trying to learn more about how well your eyes work. I want to learn about the types of visual defects that affect kids your age.

If you agree, you will be asked to complete a survey. You will have an eye test performed on you. You will also be asked to read the letters on chart and answer certain questions. The test will take about 30 minutes.

You do not have to put your name on the survey. You do not have to be in this study. No one will be mad at you if you decide not to do this study. Even if you start, you can stop later if you want. You may ask questions about the study. If you decide to be in the study I will not tell anyone else what you say or do in the study. Even if your parents or teachers ask, I will not tell them about what you say or do in the study.

Signing here means that you have read this form, or have had it read to you, and that you are willing to be in this study.

Participant's name \_\_\_\_\_

Signature of participant \_\_\_\_\_

Signature of investigator \_\_\_\_\_

date \_\_\_\_\_

#### APENDIX V: INFORMED PARENTAL CONSENT FORM

I invite your child to take part in a research study being conducted by Abigail Masuka who is a student at Bindura University of Science Education, as part of my of research project to determine the eye problem that affect school children. The study, as well as your rights as a participant, is described below.

**Description:** This study will examine common eye problems that affect school children. Children will have their eyes examined and will be asked to answer certain questions. Your child's identity will not be revealed to anyone but the principal investigator.

**Confidentiality:** Children's answers will be not being associated with their name. Rather, each child will be given an identification number on the interviewer's sheet.

**Risks & Benefits:** There are no risks to your child's safety. Because the interview engages children having their eyes examined, there are potential benefits to your child's health if eye problems are detected at an early stage.

**Freedom to Withdraw or Refuse Participation:** Your child has the right to stop participation in the study at any time, or to refuse to answer any of the interviewer’s questions without prejudice from the investigator.

**Questions?** Please feel free to ask the investigator any questions before signing the consent form or at any time during or after the study.

**Principal Investigator:** Abigail Masuka, Optometry student at Bindura University of Science Education,

**Informed Consent Statement**

I, \_\_\_\_\_, give permission for my child, \_\_\_\_\_ to participate in the research project entitled, Pattern and distribution of refractive errors among school children in Bindura town. The study has been explained to me and my questions answered to my satisfaction. I understand that my child’s right to withdraw from participating or refuse to participate will be respected and that his/her responses and identity will be kept confidential. I give this consent voluntarily.

Parent/Guardian Signature:

\_\_\_\_\_

*Signature Date*

Investigator Signature:

\_\_\_\_\_