ASSESSMENT ON THE ASSOCIATION OF MYOPIA WITH INTRAOCULAR PRESSURE IN THE UNIVERSITY OT BENIN, BENIN CITY, EDO STATE.

BY

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DEPARTMENT OF OPTOMETRY
FACULTY OF LIFE SCIENCES
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JULY, 2021.

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A THESIS SUBMITTED TO THE DEPARTMENT OF OPTOMETRY, FACULTY OF LIFE SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD DOCTOR OF OPTOMETRY (O.D) DEGREE IN OPTOMETRY

JULY, 2021.

CERTIFICATION

This is to certify that this thesis title **"Assessment on the Association of Myopia with Intraocular Pressure in the University of Benin, Benin City, Edo State**" was carried out by Humphrey H. DAN-JUMBO with Matriculation Number LSC1304347, in the Department of Optometry, Faculty of Life Sciences, University of Benin, Benin City in partial fulfillment of the requirements for the Award of the Degree, Doctor of Optometry (OD).

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DEDICATION

First and foremost, all dedication must gravitate towards my Empyrean Totem Simulacre whose infinite mercy and grace have sustained me thus far. Secondly to my Late Father Elder Horace G.O. Dan-Jumbo, Mum and siblings whose support and goodwill have never been found wanting.

ACKNOWLEDGEMENT

I thank God for the inspiration, resources, patience, perseverance and resolve to both start and finish this project, and in coming this far.

To my Late father, Elder Horace G.O. Dan-Jumbo, all I can say is that it is happening and your son is bringing it home. To my Mum: Mrs. Eremina Horace Dan-Jumbo whose prayers has been ceaseless, I appreciate you. To my co-sponsors and Benefactors; Dr. Idanye Horace Dan-Jumbo and Mr. Horace Jnr. Dan-Jumbo, thanks for all the support.

I am highly indebted to my amiable supervisor: Dr. (Mrs.) A.B. Osaiyuwu for her excellent supervisory role and motherly guidance during this project.

I am thankful to my Head of Department as well as all the lecturers in the Department and beyond, for contributing to my academic and holistic growth all through the years. To the Interesting people I met during the journey, thank you for the memories and impact.

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ABSTRACT

BACKGROUND INFORMATION: While existing data shows that increased Intraocular pressure predisposes individuals to glaucoma, it is a challenge figuring out if increased IOP can be traced to myopia.

PURPOSE: To investigate if myopia affects IOP in people of various ages and gender.

MATERIALS AND METHODS: A total of one hundred and two (102) myopes of power (-0.50D to over -6.0D) was recruited for this study. The myopic powers were measured objectively by Retinoscopy and Subjectively by Subjective Refraction with a Trial lens set and Snellens Visual Acuity Chart while the IOP was measured via the Perkins Handheld Applanation tonometer

DATA ANALYSIS: Data obtained was analyzed with the statistical package for social science (SPSS version 22.0) and the following conclusions were drawn from the results gotten;

i. The study found out that there was no significant difference between IOP in males and females as p-value was greater than 0.05.
ii. There is statistically significant difference in IOP across the three degrees of myopia groups.
iii. There is statistically significant difference in IOP across the three ages groups.
iv. There is no association between gender and degree of myopia in the study population.

CONTRIBUTION TO OPTOMETRY: This study was projected to identify and clarify any relationships between Myopia and IOP in people of various ages and gender within the university of Benin, Benin City, Edo state which was actualized with recommendations made.

CHAPTER ONE:

1.0 INTRODUCTION

Myopia is a refractive error in which rays of incident light from infinity are focused in front of the retina, in an unaccommodated state. This condition is also commonly known as shortsightedness especially among lay people. High grade myopia can increase the risk for glaucoma, retinal detachment, and chorioretinal degeneration.

There is higher prevalence of glaucoma among myopic Mitchell *et al.,* (2000) eyes than in any other refractive errors or emmetropic eyes. The relative risk of open angle glaucoma is found to increase incrementally as refractive status shifts from hypermetropia to myopia, becoming many times greater for myopia of - 5D or more as compared with hypermetropia. Interestingly, glaucoma in myopic subjects is said to be pressure mediated.

The relationship between refractive error and IOP is another area of discrepancy. Some studies have suggested that myopia may be associated with risk of primary open-angle glaucoma and hyperopia with possible risk of ocular hypertension. Considering this variability in IOP in different populations and the inconsistencies in relation to IOP with age, gender and refractive error, it is interesting to investigate the distribution of IOP and its associated factors in various populations.

This study will examine the distribution of IOP and its association with age and the refractive error in non-glaucomatous participants as a hospital-based experimental study carried out in the University of Benin, Benin City, Edo State.

1.1 Background information

1.1.1 Myopia

Hornbeam and Young (2013) describe myopia, or nearsightedness, as the most common human eye disorder in the world, and is a significant global public health concern. Along with cataract, macular degeneration, infectious disease, and vitamin A deficiency, myopia is one of the most important causes of visual impairment worldwide. Severe or high-grade myopia is a leading cause of blindness because of its associated ocular co-morbidities of retinal detachment, macular choroidal degeneration, premature cataract, and glaucoma. Ample evidence supports heritability of the non-syndromic forms of this condition, especially for high-grade myopia- commonly referred to as myopic spherical refractive power of 5–6 diopters or higher.

Consideration is needed to assess the role of environmental factors to genetic influences, such as interactions of early-age near-work or outdoor activity with genotype. Consideration is also needed in identifying phenotypes indicating etiologically homogeneous subgroups, e.g. early age-of-onset, with/without retinal degenerative changes, or classification by individual response to accommodation reduction treatments such as progressive addition lens use.

1.1.2 Intraocular Pressure (IOP)

This is the fluid pressure inside the eye, created by the continual renewal of fluids within the eye. Since the identification of intraocular pressure as a risk factor for glaucomatous damage, attempts have been made to measure IOP through the eyelid, obviating the need for topical anesthetic and the risk of eye-to-eye transfer of pathogenic organisms. The simplest way to accomplish this is with the fingers, but, perhaps, with very few exceptions, digital (meaning with fingers) impressions are at best qualitative and at worst not correlative with real IOP. Stamper and Drake (2009) posit that a reasonable qualitative (or semi-quantitative) assessment can be

made in situations where other, more accurate, devices are not practical, such as in young children, demented patients and severely developmentally-challenged patients.

In addition to all the problems facing indentation tonometry, such as scleral rigidity, transpalpebral tonometry adds variables such as the thickness of the eyelids, orbicularis muscle tone and potential intrapalpebral scarring. Recently, two attempts have been made to develop more quantitative transpalpebral IOP measuring devices. The TGDc-01 (Envision Ophthalmic Instruments, Livonia, Michigan, USA) was developed in Russia and bases its measurement on a weight falling within the instrument onto the closed eyelid and the amount of indentation it causes. Initial studies suggested good correlation with Goldmann tonometry, but more rigorous, controlled studies suggest that, at least in a significant minority of patients not identifiable prospectively, the accuracy is limited. Furthermore, interobserver and intraobserver variability was large, making the readings unreliable for most clinical purposes.

Fresco(1998) had an ingenious idea that pressure on the eyelid in most eyes produces retinal phosphenes. The pressure on the eyelid required to induce these phosphenes is proportional to the intraocular pressure. He then developed this into a usable transpalpebral tonometer – the Proview (Bausch & Lomb, Rochester, NY, USA) – found good correlation with Goldman applanation tonometer. Other studies raised the promise that patients could measure their own IOP at home, or wherever they were, and obtain information about their diurnal IOP variation that would be useful in managing their glaucoma.

Unfortunately, subsequent studies failed to confirm the accuracy of this device. The Proview could still be useful for diurnal IOP estimations by patients themselves if several validating measurements are made side-by-side with the Goldman or other accurate transcorneal tonometer.

1.1.3 Intraocular Pressure and Myopia

The refractive state of the human eye depends on a balance of change in overall eye size and refractive components namely the cornea and crystalline lens. Overall, the change in axial length tends to outweigh the progressive corneal flattening with age in normal eyes.

The interaction between the axial length, corneal radius of curvature and lens determines the eventual refractive state of the eye rather than axial length alone. Sorsby *et al* (2003). considered that changes in axial length were crucial in determining the architecture of the globe and that myopia resulted from a failure of the cornea and lens to compensate for the axial elongation.

However Sowjana *et al* (2015) found that in addition to myopes having higher IOP, there is also a positive correlation between IOP and myopia. They concluded that since subjects with refractive error are at greater risk of developing glaucoma, these subjects require regular monitoring to prevent ocular pathology and blindness.

Intraocular pressure (IOP) plays an important role in the pathogenesis of glaucoma and has been hypothesized to be one of several factors implicated in the pathogenesis of myopia.

Elevated IOP is said to impose scleral stress and creep, resulting in axial eye elongation with scleral stretch. Several studies have evaluated the relation between IOP and myopia development with controversial results. Some studies reported a positive association while others found no such relationship between IOP and myopia. However, the nature and extent of the influence of IOP on eye growth remains poorly understood.

1.1.4 Intraocular Pressure and Myopia in Men and Women of Various Ages

Jeelani *et al* (2014) found that mean intraocular pressure increases with increasing age group with higher value seen in females. By this study, they evaluated subjects who are at risk of

developing Glaucoma especially those ones who have myopia. Since increase in IOP, is one of the risk factor. The mean IOP above the age of forty years, is 15.2 mmHg in males and 16.5 mmHg in females, this increases to 18.5 mmHg in the 71-80 years age group. Ocular hypertension and glaucoma suspect should be considered with IOP>22 mmHg in subjects above forty years of age provided that there is neither structural nor functional glaucoma-specific damage of the optic nerve.

Glaucoma should be considered when IOP is above 21 mmHg even in the absence of such damage. It would be more accurate if ophthalmologists acquire the habit of approximating measured IOP to the nearest one mmHg and not to the nearest even number.

1.2 STATEMENT OF PROBLEM

Many people suffer from ocular hypertension, glaucoma and other conditions that can be caused by an increase in the normal intraocular pressure. Some of these people with a raised IOP are myopes. From the body of knowledge available in vision science, it is not exactly clear if myopia can predispose individuals to raised IOP and by extension the ocular conditions that come with it.

1.3 AIM AND OBJECTIVE

Aim

To investigate if myopia affects IOP in people of various ages and gender in the University of Benin, Benin City, Edo State.

Objectives

- To measure the IOP in male and female myopes of various age groups in the University of Benin, Benin City, Edo State.
- To compare the degree of Myopia in male and female myopes of various ages in the University of Benin, Benin City, Edo State to their IOPs.
- To determine the relationship between Myopia and IOP in the University of Benin, Benin City, Edo State.

1.4 Research Questions

- Is there an association between Myopia and Intraocular Pressure amongst male and females of various ages in the University of Benin, Benin City, Edo State?

1.5 Hypotheses

1. There is no association between Myopia and Intraocular Pressure amongst males and females of various ages in the University of Benin, Benin City, Edo State.

1.6 Significance of the Study

- To enlighten eye care practitioners and medical practitioners on the relationship between myopia and intraocular pressure with regards to age and gender as a way to improve clinical knowledge.
- To improve and help speedup diagnostic processes in eye clinics.
- To serve as bedrock for further related studies.

1.7 Definition of terms

Myopia: A condition in which close objects appear clearly but far ones does not. It is referred to as Near sightedness.

Hyperopia: A condition in which far objects appear clearly but near ones does not. It is referred to as Far sightedness.

Intraocular pressure: The fluid pressure inside the eye. It is created by the continual renewal of fluids within the eye.

Glaucoma: A group of eye conditions that can cause blindness. With all type of glaucoma, the nerve connecting the eye to the brain (optic nerve) is damaged, usually due to high intraocular pressure.

CHAPTER TWO:

2.0 LITERATURE REVIEW

2.1 Intraocular Pressure and Myopia

A study conducted by Anil and Nitnavre, (2018), on the correlation between intraocular pressure and myopia repealed a positive association between the two. The study included 100 eyes of 50 patients aged between 11-52 years of both genders. After obtaining informed consent from all patients, a complete ocular examination including slit lamp examination, dilated fundus examination, retinoscopy and refraction was carried out. Visual acuity for distant vision was measured by Snellen's chart. Goldmann applanation tonometer was used for measuring the intraocular pressure by the same investigator in all cases.

Yassin and Al-Tamim (2015) made an interesting discovery when they investigated the relationship between myopia and increased IOP with Saudi participants. The population they surveyed was 655, but after excluding 194 subjects due to missing data, 2 subjects who were known to have glaucoma and were using anti-glaucoma medication, and one subject because of the outlier on statistical analysis, 458 people were included in the study. With history of diabetes present in 24 participants and hypertension in 12 participants, a total of 458 eyes (randomly chosen either right or left eye) of healthy Saudi people; 269 males (58.7%) and 189 females (41.3%) were selected in this study. The Mean (SD) age was 43.0 ± 12.6 years. They found that there was no significant difference in age between the male participants (43.7 ± 12.5 years) and female participants (42.0 ± 12.7 years), ($p = 0.159$). The overall mean of IOP was 15.8 ± 3.6mmHg, and the median IOP of total subjects was 15 (range: 6–28) mmHg. The median IOP of men was 15 (range: 6–28) mmHg and 16 (range: 6–28) mmHg for women, which was not

statistically significant ($p = 0.268$). The relationship between IOP and age was found to vary in different geographical areas and racial groups. There is no sufficient evidence to conclude that intraocular pressure in Saudi participants is related to gender, age or refractive error. The median IOP in this study is different from that in various studies in other geographical regions. The observations need confirmation by study with larger sample representing Saudi population.

Chinawa *et al* (2017) also investigated the relationship between myopia and intraocular pressure. For this study, they chose 80 myopes and 80 emmetropes. Existing knowledge already shows myopes have a statistically significant longer axial length than emmetropes. As a result, there is a linear correlation between axial length and degree of myopia such that the longer the axial length, the higher the degree of myopia. However, there is a poor linear correlation between IOP and axial length. But more importantly, they found that there is poor linear correlation between IOP and myopia.

They made the following recommendations based on these findings: Since there is poor correlation between myopia and IOP, the use of ocular hypotensive in retarding myopia progression remains questionable. Since there is poor correlation between myopia and IOP, other theories of the pathogenesis of myopia acting independent of IOP should be closely considered with the aim of reducing myopic progression.

Still on the relationship between myopia and increased Intraocular pressure, Osaiyuwu and Edokpa (2018) figured out that there is indeed a relationship between the two. In a research conducted as a retrospective study at the Optometry/Ophthalmology Department of the Stella Obasanjo Women and Children Hospital, Benin City, Edo State, Nigeria on 166 subjects with glaucoma and refractive error (Myopia and hyperopia) they found the following: Newly

diagnosed glaucomatous myopes had a significantly higher mean IOP than recently diagnosed hyperopes (unpaired t- test, p= 0.004). Myopes also had a wider and higher range of IOP values compared to hyperopes. A good number of myopes had IOP values that could be rated as higher than normal.

Joseph *et al* (2016) in a similar study, concluded that there is statistically significant correlation ($p<0.05$) between IOP and myopia, in moderate and high myopia groups. The IOP was higher in those groups than in emmetropia and low myopia thereby increasing the risk of glaucoma in these patients. They arrived at this conclusion after an observational study done from January to May 2014 in which 178 eyes of 100 patients were divided into four groups according to their refractive status. Group 0 – Emmetropia (+0.5 to -0.5D), Group1- low myopia (-0.75 to -3.00D), Group 2 -moderate myopia (-3.00 to -5.00D) and Group 3 - high Myopia (>-5.00D).

In another similar study, Choi *et al* (2014) investigated the relationship between refractive errors and increased Intraocular pressure. The study which was performed on 7277 adults aged 19 and above in Korea showed Myopic refractive error was an independent predictor of higher IOP in non-glaucomatous eyes, and the association between refractive error and IOP differed according to age.

2.2 Intraocular pressure and age

On change of Intraocular pressure with age and across both genders, Baek *et al* (2015), made an interesting discovery. They found that IOP significantly decreased with age, although the amount of change was small. In women and older age groups, IOP was less decreased than that of men and young age groups. In addition, IOP was positively associated with systolic blood pressure and heart rate. A further study with large study populations and longer follow-up periods will be needed in the future. They had performed this study on 31,857 South Korean subjects.

2.3 Myopia and glaucoma

It is important to note that Mitchell *et al* (1999) had already established a strong relationship between Myopia and glaucoma whether induced by increased IOP or not. In a study that included 3,654 Australians aged 49 to 97. Myopic subjects had a twofold to threefold increased risk of glaucoma compared with that of non-myopic subjects.

2.4 Gender and intraocular pressure

Baisakhiya *et al* (2016) found in a study of 300 healthy individuals aged 40 to 79, that gender has no significant correlation with IOP, while increasing age is a risk factor for raised IOP and hence for glaucoma. Higher waist-hip ratio is positively correlated with IOP in both genders. Periodic checking of IOP in elderly and overweight individuals can play an important role in reducing the morbidity due to glaucoma. Lifestyle modification in the form of exercise and dietary alteration can also be an important preventive measure.

2.5 Age and myopia

While myopia appears to increase in power as an individual ages, Hu *et al* (2020) noted a relationship between age and myopia as is relevant to this study. They carried out a cohort study of 443 individuals with myopia which showed that the risk of developing high myopia was greater than 50% for those with myopia onset at 7 or 8 years of age. The risk substantially decreased to approximately 30% for onset at 9 years of age, 20% for onset at 10 years of age, and less than 5% for onset at 12 years or older. Their findings suggest that the risk of high myopia is relatively high in children with myopia onset during the early school ages. Each year of delay in the age at onset substantially reduces the chance of developing high myopia and/or related complications such as increased Intraocular pressure in adulthood.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Research Design

This is an Observational Cross-sectional Study

3.1.1 Study Location

This research was carried out at the University of Benin Optometry Teaching Clinic.

3.1.2 Study Population

The study population were Subjects working, Schooling or residing within the University of Benin, Benin City, Edo State.

3.1.3 Study Duration

The study spanned for a period of eight weeks.

3.1.4 Sampling Technique

The sampling technique used in this study is the Judgmental (or Purposive) sampling technique.

3.1.5 Sample Size

Using the Fisher's formula

$$N = \frac{Z^2 Pq}{D^2}$$

Where

N= sampling size

P= prevalence or proportion of target population 6.5%

Q= 1 –P

Z= 1.96 constant

$$N = \frac{(1.96)^2 \times 0.065 \times 0.923}{(0.05)^2}$$

N=92.14

Considering the attrition factor of 10%

The new sample size = calculated sample size + attrition factor of 10%

10% x 92.14= 9.21

92.14+ 9.21 = 101.5 =102

3.1.6 Research Materials

- Perkins Handheld applanation tonometer
- Trial lens set
- Trial frame
- Retinoscope
- Ophthalmoscope
- Distance acuity chart (Snellen's chart)
- Penlight

3.1.7 Inclusion Criteria

- Myopic Subjects
- Subjects aged 5 years and above
- Subjects willing to submit to the testing procedures

3.1.8 Exclusion Criteria

- Emmetropes and Hyperopes
- Myopes under the age of 5
- Subjects with any known pathological condition

- Subjects under IOP regulation medication

3.2 Ethical Consideration

Ethical clearance for the study was obtained from the Ethical Committee of the Department of Optometry, University of Benin.

A detailed rationale for the study was explained to subjects, and their consent (verbal/ written) was sought for and obtained. The research was done according to Helsinki Declaration involving human subjects.

3.3 Procedure

One hundred and two myopic subjects, who had undergone screening to determine if they were truly myopic and if they were free from any known pathological condition that could compromise the authenticity of the study were selected through Judgmental (or Purposive) sampling technique and recruited for the study. The subjects of various myopic powers were grouped into three major group ranges,(-0.50DS to -2.75DS, -3.00DS to -6.00DS and Over -6.00DS)

This study spanned for a period of eight weeks and involved two major procedures.

Refraction

Objective refraction was performed with a retinoscope then followed by subjective refraction with the Snellens Visual Acuity Chart and trial lens set.

IOP Testing

Following the procedure above, the subjects' intraocular pressure was tested using the Goldmann applanation tonometer. All IOP testing was done in the mornings during the hours of 9:30am and 11:30am.

After the two procedures above was completed, the data collated was analyzed statistically and conclusions were drawn from them. IOP figures were compared across the three groups above and across gender and age as the research sort to identify and establish patterns.

3.4 Data Analysis

Data collected was subjected to statistical analysis using the Statistical Package for Social Sciences (SPSS version 22.0). Pearson's correlation test was used to correlate the IOP of the left and right eyes. Normally distributed data was analyzed with parametric one way analysis of variance; post hoc test; unpaired t-test; and Chi Square test. Also tables, figures and charts was constructed. Measurement of central tendencies was calculated and presented in tables.

3.5 Limitations of Study

1. Unwillingness of some subjects to undergo the tests required in this procedure.
2. Short time frame for the study.

CHAPTER FOUR

4.0 Results

A total of 102 subjects were recruited for this assessment. They were all myopes of various powers and where grouped into three major group ranges,(-0.50DS to -2.75DS, -3.00DS to -6.00DS and Over -6.00DS). The following results were obtained

4.1 Results and Analysis

A total of 102 Myopic subjects were recruited for this assessment. Of the population, 55 (54.6%) were males and 47 (46%) were females. The mean Intraocular Pressure for male was 18.69mmHg while that of female was 18.55mmHg which revealed that there was no statistically significant difference between the intraocular pressure in males and females, though there was an increase of the mean intraocular pressure when compared to the three groups of myopic power ranges.

T-Test

Table 1: Descriptive Statistics Table for Gender and IOP

Group Statistics

	gender	N	Mean	Std. Deviation	Std. Error Mean
IOP	male	55	18.6909	3.64576	.49159
	female	47	18.5532	3.21551	.46903

Table 2: Independent Samples Test (Test for equality of variance)					
		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	T	df
IOP	Equal variances assumed	2.984	.087	.201	100
	Equal variances not assumed			.203	99.890

Table 3a: Independent Samples Test (Test for equality of Mean)					
		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
IOP	Equal variances assumed	**.841**	.13772	.68621	-1.22370
	Equal variances not assumed	.840	.13772	.67945	-1.21031

Table 3b: Independent Samples Test (Test for equality of Mean)		
		t-test for Equality of Means
		95% Confidence Interval of the Difference
		Upper
IOP	Equal variances assumed	1.49914
	Equal variances not assumed	1.48575

H_0

There is no significant difference between the iop in males and females.

Because p-value > 0.05, therefore H0 is accepted

Table 4: Descriptive Statistics Table for Degree of myopia groups					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	-0.50DS to -2.75DS	42	39.6	41.2	41.2
	-3.00DS to -6.00DS	37	34.9	36.3	77.5
	> -6,00DS	23	21.7	22.5	100.0
	Total	102	96.2	100.0	
Missing	System	4	3.8		
Total		106	100.0		

Table 5: Descriptive Statistics Table for Degree Age groups					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	5-30years	36	34.0	35.3	35.3
	31-60years	50	47.2	49.0	84.3
	>60years	16	15.1	15.7	100.0
	Total	102	96.2	100.0	
Missing	System	4	3.8		
Total		106	100.0		

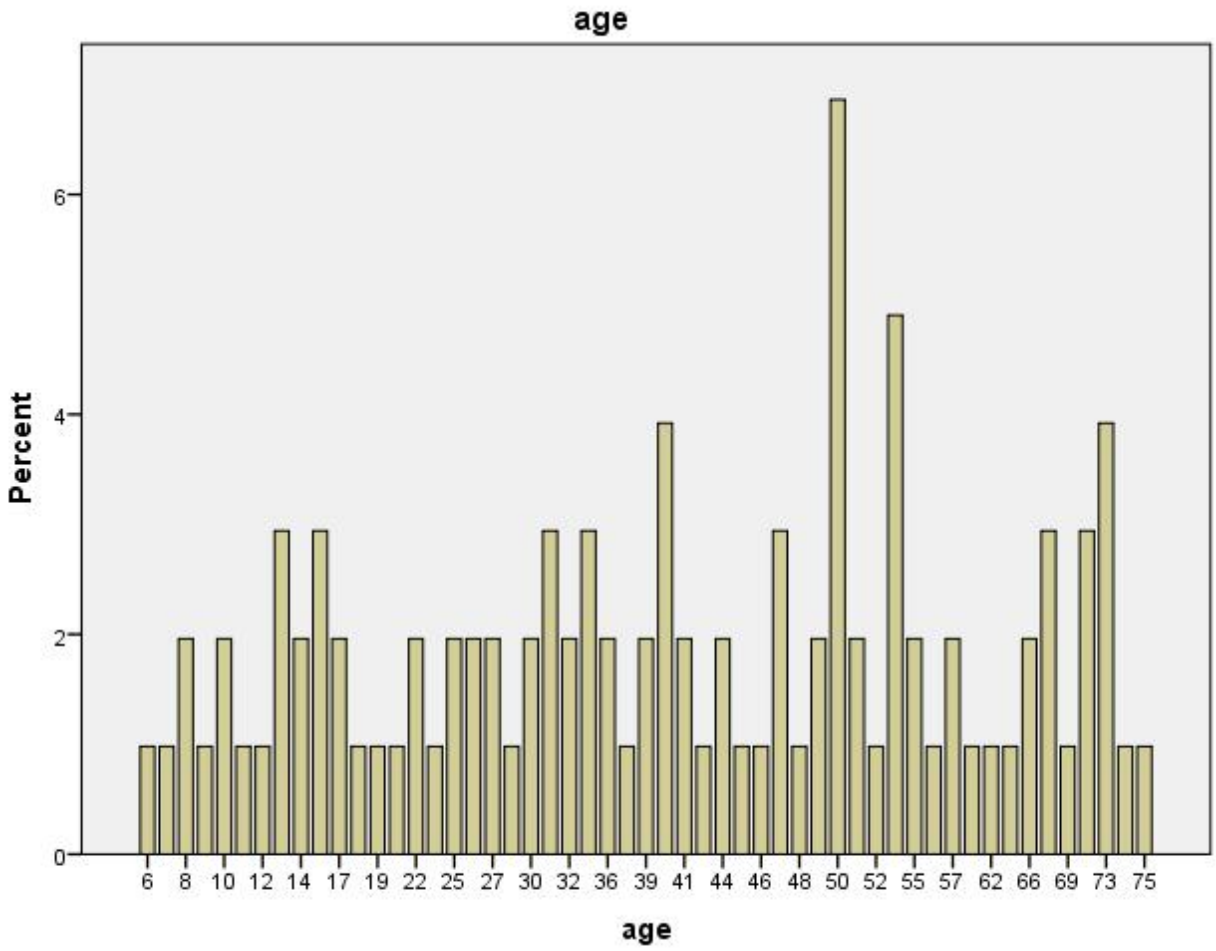

Figure 1: Bar Chart of age distribution of the study population

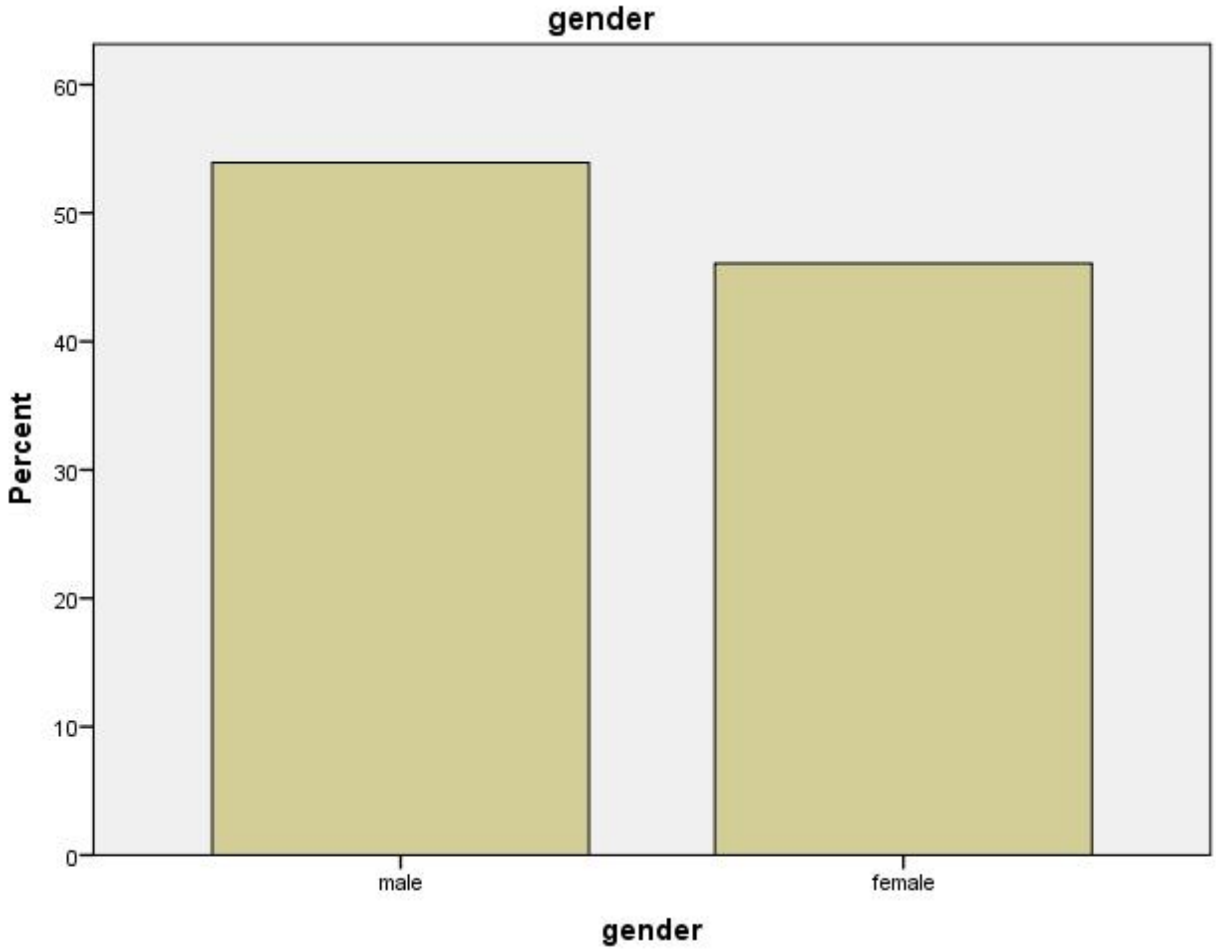

Figure 2: Bar Chart of gender distribution of the study population

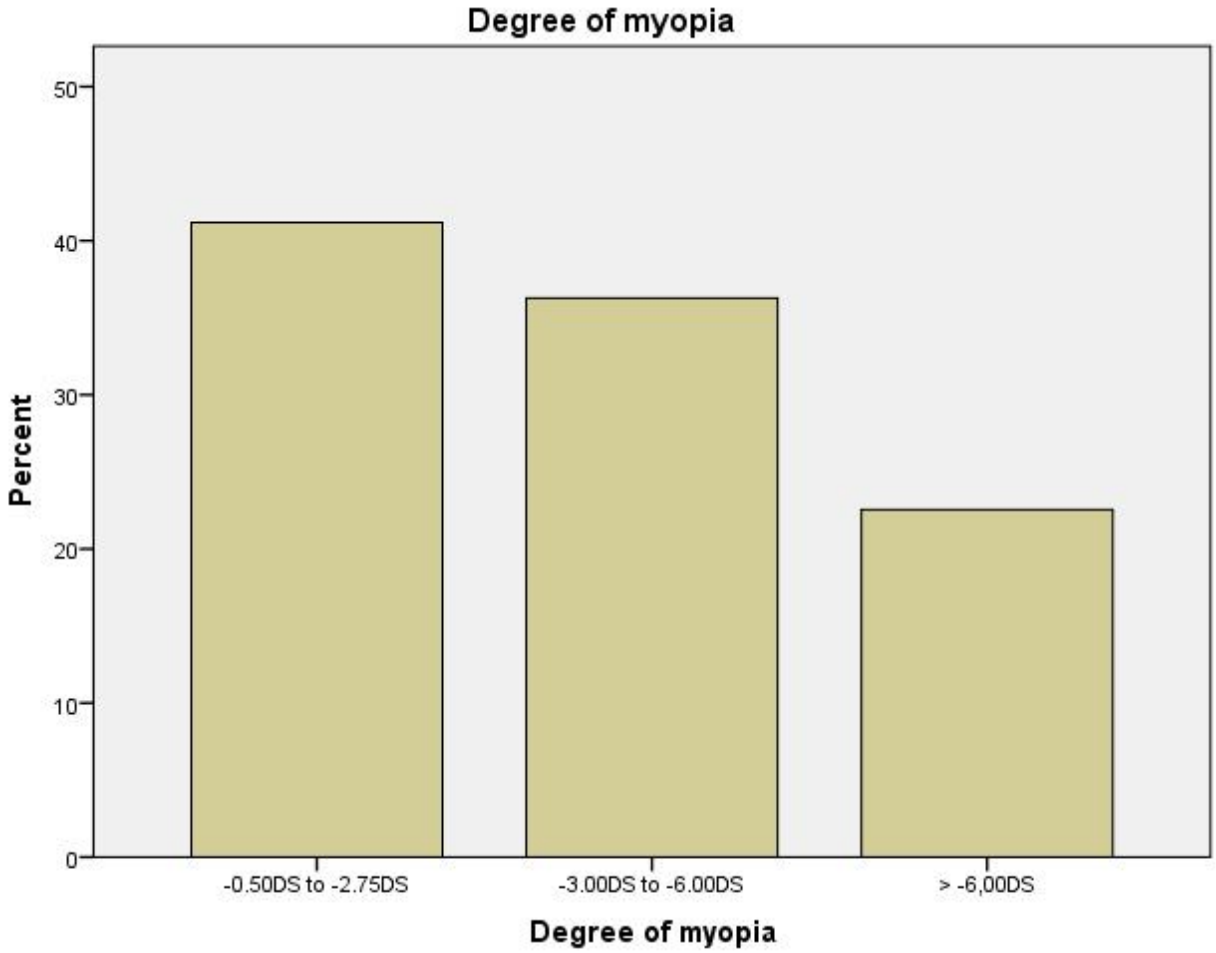

Figure 3: Bar Chart of degree of myopia distribution of the study population

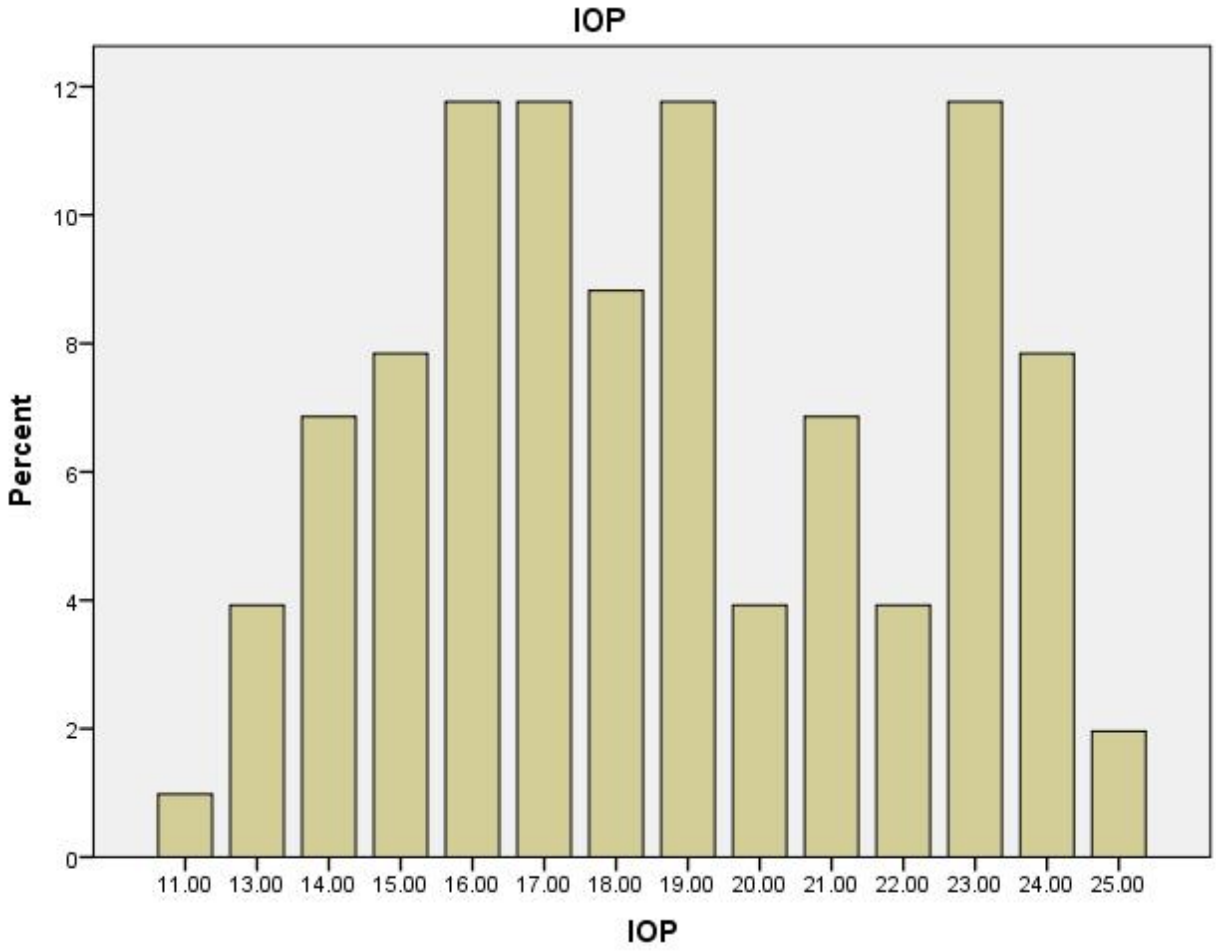

Figure 4: Bar Chart of IOP distribution of the study population

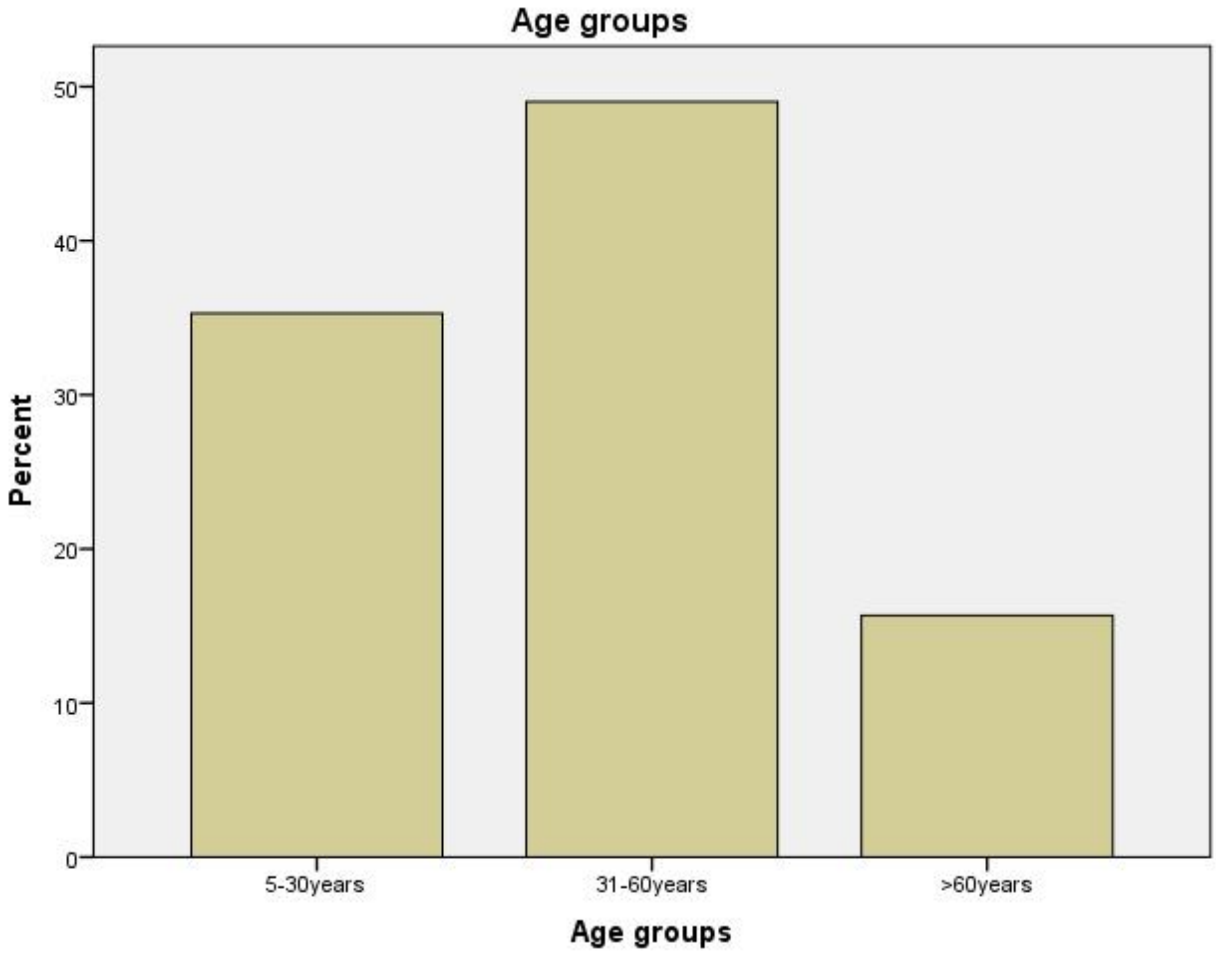

Figure 5: Bar Chart of subjects' population percentage in the age groups

Table 6: Analysis of variance relationship between IOP and Myopia groups

ANOVA IOP					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	22.101	2	11.050	.934	**.397**
Within Groups	1171.742	99	11.836		
Total	1193.843	101			

Table 7a: Post Hoc Tests for Multiple Comparison of IOP with degree of Myopia groups

Multiple Comparisons					
Dependent Variable: IOP					
	(I) Degree of myopia	(J) Degree of myopia	Mean Difference (I-J)	Std. Error	Sig.
LSD	-0.50DS to -2.75DS	-3.00DS to -6.00DS	-.92857	.77569	.234
		> -6,00DS	-.97205	.89241	.279
	-3.00DS to -6.00DS	-0.50DS to -2.75DS	.92857	.77569	.234
		> -6,00DS	-.04348	.91350	.962
	> -6,00DS	-0.50DS to -2.75DS	.97205	.89241	.279
		-3.00DS to -6.00DS	.04348	.91350	.962

Table 7b: Post Hoc Tests for Multiple Comparison of IOP with degree of Myopia groups

Multiple Comparisons				
Dependent Variable: IOP				
	(I) Degree of myopia	(J) Degree of myopia	95% Confidence Interval	
			Lower Bound	Upper Bound
LSD	-0.50DS to -2.75DS	-3.00DS to -6.00DS	-2.4677	.6106
		> -6,00DS	-2.7428	.7987
	-3.00DS to -6.00DS	-0.50DS to -2.75DS	-.6106	2.4677
		> -6,00DS	-1.8561	1.7691
	> -6,00DS	-0.50DS to -2.75DS	-.7987	2.7428
		-3.00DS to -6.00DS	-1.7691	1.8561

Table 7c: Post Hoc Tests for Multiple Comparison of IOP with degree of Myopia groups

Homogeneous Subsets

IOP			
	Degree of myopia	N	Subset for alpha = 0.05
			1
Student-Newman-Keuls[a,b]	-0.50DS to -2.75DS	42	18.0714
	-3.00DS to -6.00DS	37	19.0000
	> -6,00DS	23	19.0435
	Sig.		.500
Duncan[a,b]	-0.50DS to -2.75DS	42	18.0714
	-3.00DS to -6.00DS	37	19.0000
	> -6,00DS	23	19.0435
	Sig.		.293

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 31.808.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

H_o
There is no statistically significant difference in IOP across the three degrees of myopia.

p-value = -0.002

Because p-value < 0.01, therefore H0 is rejected

i.e There is a statistically significant difference in IOP across the three degrees of myopia

Table 8a: Analysis of variance relationship between IOP and Age groups

ANOVA					
IOP					
	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	26.153	2	13.077	1.109	.334
Within Groups	1167.690	99	11.795		
Total	1193.843	101			

Table 8b: Post Hoc Tests Multiple Comparisons IOP and Age groups

Multiple Comparisons						
Dependent Variable: IOP						
	(I) Age groups	(J) Age groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval
						Lower Bound
LSD	5-30years	31-60years	-.90778	.75069	.229	-2.3973
		>60years	-1.34028	1.03190	.197	-3.3878
	31-60years	5-30years	.90778	.75069	.229	-.5817
		>60years	-.43250	.98645	.662	-2.3898
	>60years	5-30years	1.34028	1.03190	.197	-.7072
		31-60years	.43250	.98645	.662	-1.5248

Table 8c: Post Hoc Tests Multiple Comparisons IOP and Age groups

Multiple Comparisons

Dependent Variable: IOP

	(I) Age groups	(J) Age groups	95% Confidence Interval
			Upper Bound
LSD	5-30years	31-60years	.5817
		>60years	.7072
	31-60years	5-30years	2.3973
		>60years	1.5248
	>60years	5-30years	3.3878
		31-60years	2.3898

Table 8d: Post Hoc Tests Multiple Comparisons IOP and Age groups

Homogeneous Subsets

IOP			
	Age groups	N	Subset for alpha = 0.05
			1
Student-Newman-Keuls[a,b]	5-30years	36	17.9722
	31-60years	50	18.8800
	>60years	16	19.3125
	Sig.		.325
Duncan[a,b]	5-30years	36	17.9722
	31-60years	50	18.8800
	>60years	16	19.3125
	Sig.		.178

Means for groups in homogeneous subsets are displayed.
a. Uses Harmonic Mean Sample Size = 27.204.
b. The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed.

H_o

There is no statistically significant difference in iop across the three age groups.

p-value = -0.002

Because p-value < 0.01, therefore H0 is rejected

ie There is a statistically significant difference in iop across the three age groups.

Table 9: Chi square test varying degree of myopia with gender to test for association

Degree of myopia * gender Crosstabulation					
			Gender		Total
			male	female	
Degree of myopia	-0.50DS to -2.75DS	Count	26	16	42
		Expected Count	22.6	19.4	42.0
	-3.00DS to -6.00DS	Count	18	19	37
		Expected Count	20.0	17.0	37.0
	> -6,00DS	Count	11	12	23
		Expected Count	12.4	10.6	23.0
Total		Count	55	47	102
		Expected Count	55.0	47.0	102.0

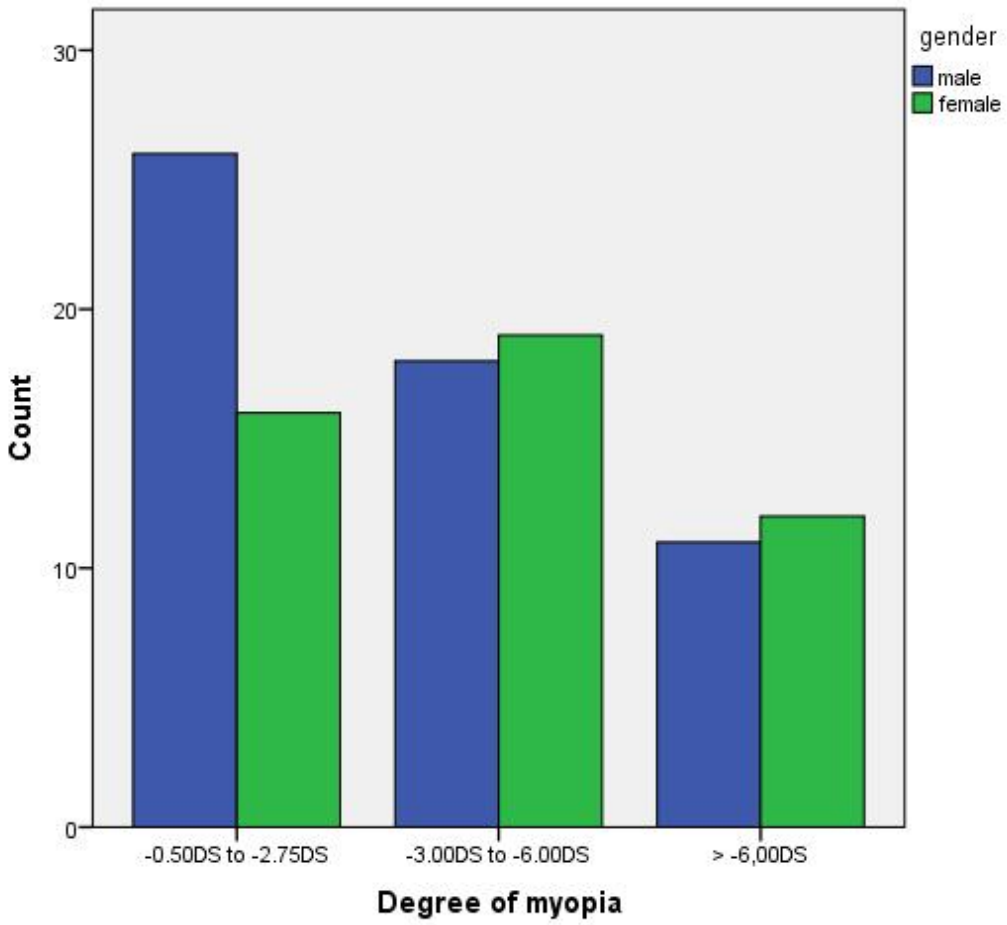

Figure 6: Bar Chart of association between gender and degree of myopia

Analysis

H0

There is no association between gender and degree of myopia in study population from the table above p-value = 0.399

We accept the hypothesis because $p > 0.05$

i.e there is no association between gender and degree of myopia in study population.

Table 10: Chi square test for varying degree of myopia with age group to test for association

Age groups * Degree of myopia Crosstabulation						
			Degree of myopia			Total
			-0.50DS to -2.75DS	-3.00DS to -6.00DS	> -6,00DS	
Age groups	5-30years	Count	22	11	3	36
		Expected Count	14.8	13.1	8.1	36.0
	31-60years	Count	15	20	15	50
		Expected Count	20.6	18.1	11.3	50.0
	>60years	Count	5	6	5	16
		Expected Count	6.6	5.8	3.6	16.0
Total		Count	42	37	23	102
		Expected Count	42.0	37.0	23.0	102.0

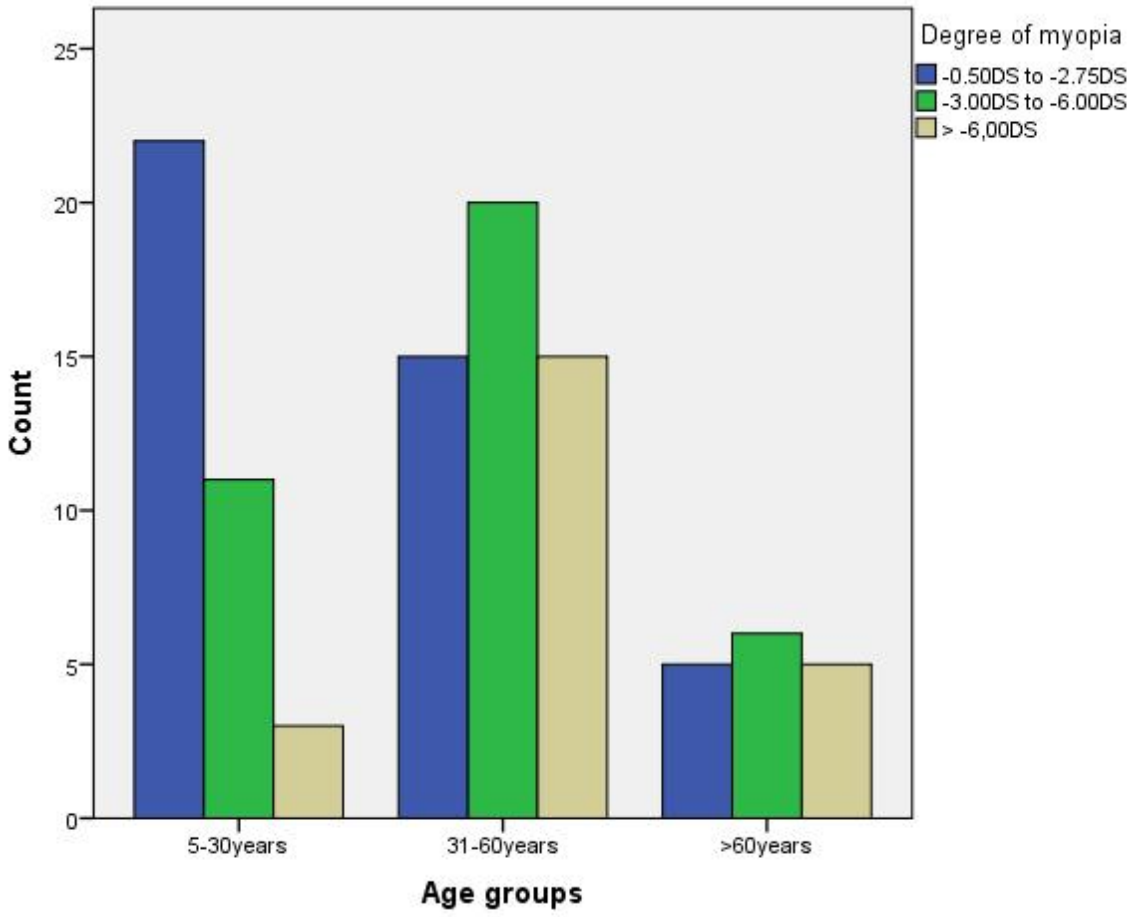

Figure 7: Bar Chart of association between age groups and degree of myopia

Analysis

H0

There is no association between age group and degree of myopia in study population

From the table above p-value = 0.028

We reject the hypothesis because $p < 0.05$

i.e there is an association between age group and degree of myopia in study population or the result is significant.

Table 11: Chi square test varying IOP and age groups to test for association

IOP * Age groups Cross tabulation						
			Age groups			Total
			5-30years	31-60years	>60years	
IOP	11.00	Count	0	1	0	1
		Expected Count	.4	.5	.2	1.0
	13.00	Count	1	3	0	4
		Expected Count	1.4	2.0	.6	4.0
	14.00	Count	4	2	1	7
		Expected Count	2.5	3.4	1.1	7.0
	15.00	Count	2	5	1	8
		Expected Count	2.8	3.9	1.3	8.0
	16.00	Count	6	4	2	12
		Expected Count	4.2	5.9	1.9	12.0
	17.00	Count	5	6	1	12
		Expected Count	4.2	5.9	1.9	12.0
	18.00	Count	5	3	1	9
		Expected Count	3.2	4.4	1.4	9.0
	19.00	Count	3	5	4	12
		Expected Count	4.2	5.9	1.9	12.0
	20.00	Count	2	2	0	4
		Expected Count	1.4	2.0	.6	4.0
	21.00	Count	3	3	1	7
		Expected Count	2.5	3.4	1.1	7.0
	22.00	Count	1	2	1	4
		Expected Count	1.4	2.0	.6	4.0
	23.00	Count	2	8	2	12
		Expected Count	4.2	5.9	1.9	12.0
	24.00	Count	1	5	2	8
		Expected Count	2.8	3.9	1.3	8.0
	25.00	Count	1	1	0	2
		Expected Count	.7	1.0	.3	2.0
Total		Count	36	50	16	102
		Expected Count	36.0	50.0	16.0	102.0

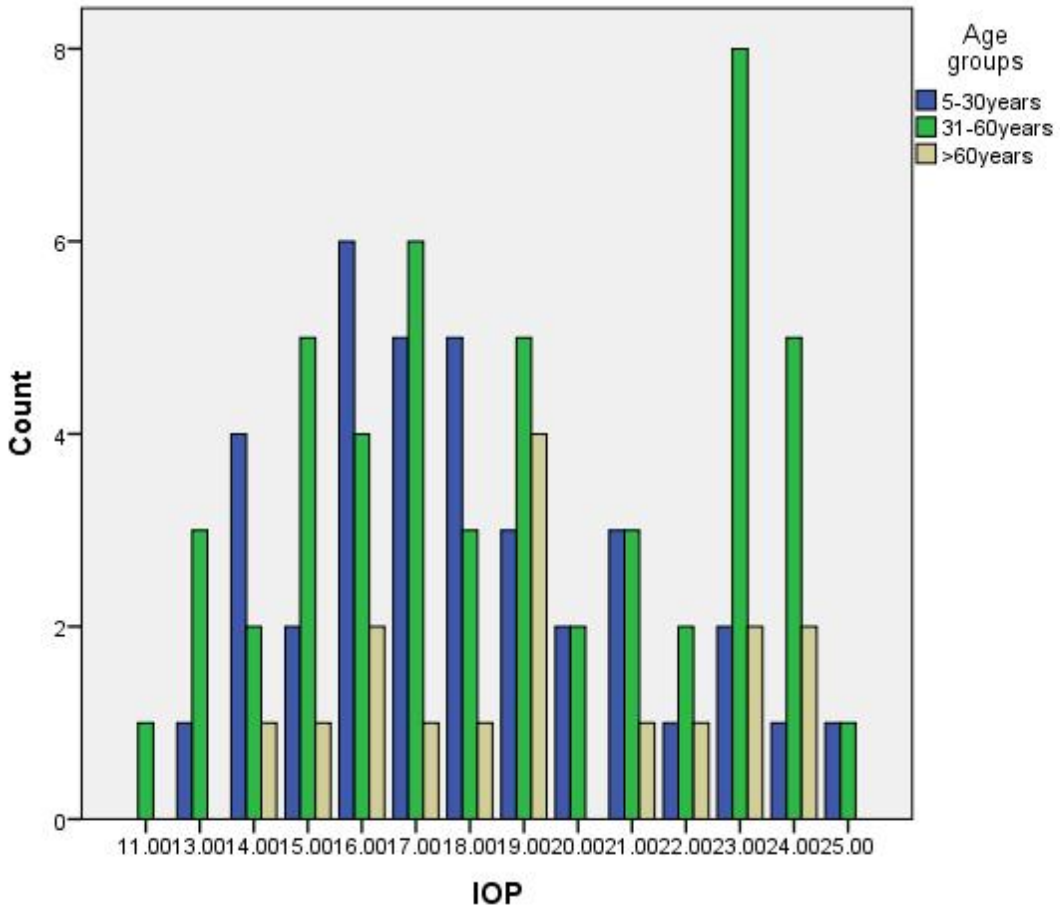

Figure 8: Bar Chart of association between age groups and IOP

Analysis

H0

There is no association between age group and IOP in study population from the table above p-value = 0.04

We reject the hypothesis because $p < 0.05$

i.e there is an association between age group and IOP in study population.

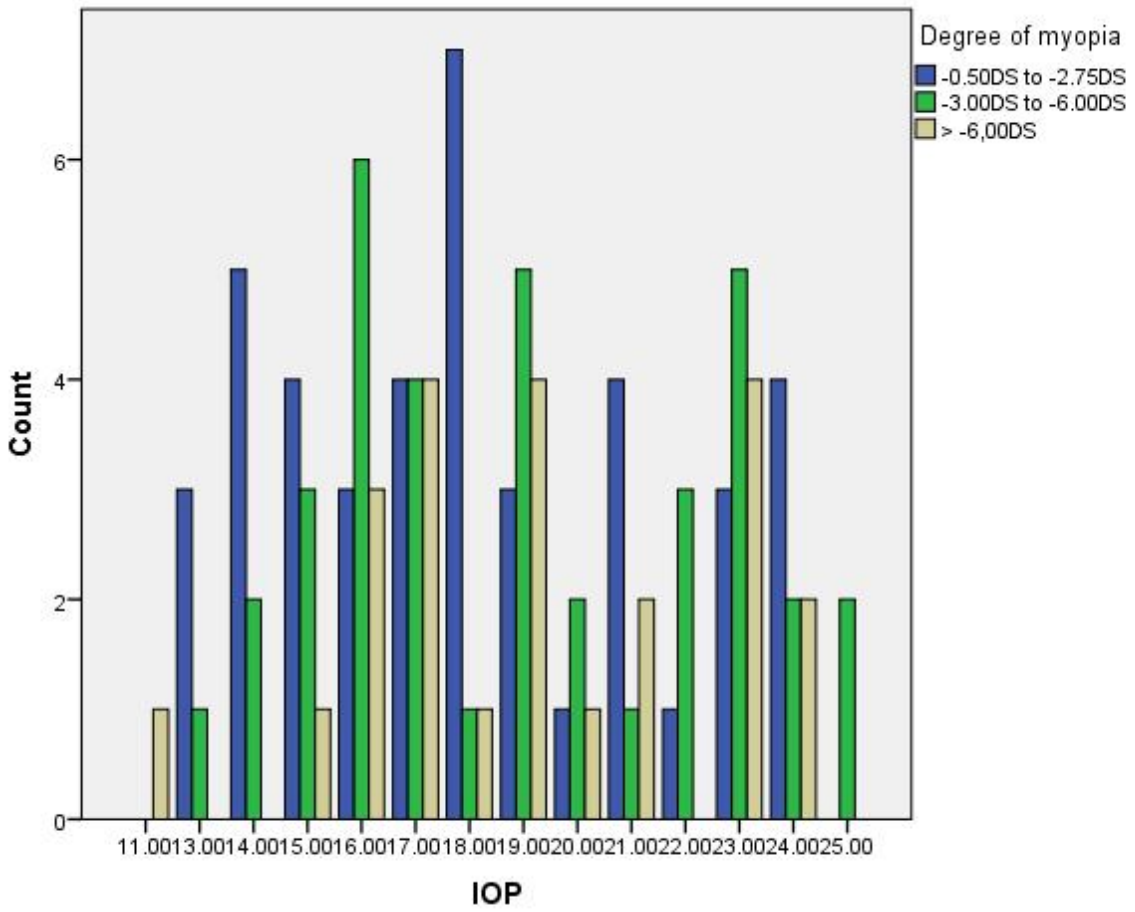

Figure 9: Bar Chart of association between degree of myopia and IOP

Analysis

H0

There is no association between degree of myopia and IOP in study population from the table above p-value = 0.03

We reject the hypothesis because p < 0.05

i.e there is an association between degree of myopia and IOP in study population

CHAPTER FIVE

5.0 DISCUSSION

55 male subjects which represent 51.9% of the total population and 47 female subjects which represent 44.3% of the total population were recruited for this study as was shown in Table 1. The subsequent tests for equality of variances and equality of means show that there isn't any significant difference between the IOP of the male and female subjects. Noticeably, p-value remained > 0.05, hence Null hypotheses (Ho) was accepted. A similar result was gotten from the research conducted by Baisakhiya *et al* (2016) using a larger sample size of 300 healthy individuals. It was gathered that gender had no significant correlation with intraocular pressure.

From Figure1 (Bar chart of age distribution of the study population) it is interesting to note that 50years is the most frequently occurring age among all participants in the study. 40.5 years was found to be the median age while 40.01 years was the obvious mean. Myopia of -1.00DS was the most common power in the sample gathered while the most common IOP measurement obtained was 16 mmHg. The figure also shows that the oldest subject was 75 years old while the youngest was 6 years old. Additionally, the highest myopic power recorded was -3.00DS while the least was -1.00DS. Similarly, 25mmHg was the highest IOP obtained while 11mmHg was the least IOP reading obtained.

Myopia of the range -0.50DS to -2.75DS accounted for 42 subjects (41.2%) of the total sample size. 37 subjects (36.3%) of total sample size had powers in the range of -3.00DS to -6.00DS. Myopic subjects whose powers were over >-6.00DS where 23 and that accounted for 22.5% of the entire sample size as shown in Table 4 (Descriptive statistics table for Degree of Myopia) and Figure 3 (Bar chart of Degree of myopia distribution of the study population)

From figure 4 (Bar chart of IOP distribution in study population), the following measurements: 16mmHg, 17mmHg, 19mmHg and 23mmHg occurred 12 times each. It can be observed that the highest reading was 25mmHg and it was recorded twice while the lowest IOP measurement was 11mmHg and was recorded once. Subjects aged 5 to 30 were 36 and accounted for 35.3% of the total sample used. Participants aged 31 to 60 years were 50 accounting for 49% of the entire sample used. However, subjects older than 60 years were 16 and accounted for 15.7% of the total sample used.

The first One Way ANOVA presented as well as the Post Hoc tests and Homogeneous Tests helped us establish reasons to reject the Null hypothesis (H_0) Stating that there is no statistically significant difference in IOP across the three degrees of myopia if p-value is > 0.01. From the test, p-value was calculated to be -0.002 which is actually lesser than 0.01, validating the rejection of the Null Hypothesis as it is evident that there is statistically significant difference in IOP across the three myopic power ranges. The same was observed for the second set of One Way ANOVA, Post Hoc tests and Homogeneous Tests. The same null hypothesis was rejected from the research conducted by Joseph *et al* (2016) when p-value was less than 0.05. Just like this study, Joseph *et al* (2016) found out that IOP was high in moderate and high myopic power ranges using a larger sample size (178) compared to the sample size used in this research.

The Chi Square tested for various degrees of myopia and how they are influenced by gender. With a p-value of 0.399 which is greater than 0.05, we accept the null hypothesis which claims there is no relationship between gender and the degree of myopia.

The second Chi Square tested for association between various degrees of myopia and age groups. With p-value of 0.028 which is less than 0.05, we reject the null hypothesis (H_O) which states that there is no association between age groups and degree of myopia in the study population when p-value is > 0.05. in this case the p-value recorded in **table 10** (age group and myopia cross-tabulation) is found to be 0.028 which is actually lesser than 0.05, validating the rejection of the Null Hypothesis as the statistics upholds that a significant association exist between degree of myopia and age groups.

Again, an association between varying IOP and age was conducted with the third Chi Square. The p-value herein obtained was 0.04 which was less than 0.05. Hence, we rejected the null hypothesis in order to establish that there is an association between

IOP and age group in the study population.

The fourth and last Chi Square tested for an association between degree of myopia and IOP in the study population. P-value obtained here was 0.03 which was less than 0.05. It indeed established that there was an association between degree of myopia and IOP in study population hence a rejection of the associated null hypothesis. It is important to note that the results obtained from all four Chi Square tests were represented in bar charts in Figure 6, 7, 8 and 9.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The following were concluded from the study:

i. There was no significant difference between IOP in males and females in the University of Benin, Benin City Edo state.
ii. There is a statistically significant difference in IOP across the three myopic power ranges
iii. There is a statistically significant difference in IOP across the three age groups
iv. There is no association between gender and degree of myopia in the study population.

Indeed Myopia affect IOP in people especially as they get older, it however didn't establish a strong disparity between raised IOPs in men and women, especially the ones that can be traced to myopic errors.

6.2 Recommendations

From the foregoing study, we can conveniently make the following recommendations:

- Patients diagnosed with moderate to high myopic errors should be advised to undergo Tonometry test in order to check their intraocular pressure level and regulate with medications if necessary so as to avoid complications associated with high intraocular pressure levels.
- These findings will receive more credibility if this research is carried out in other campuses, communities or locations and the results remain the same or almost the same.

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APPENDICES

FREQUENCIES OF AGE, GENDER, MYOPIA AND IOP CROSS TABULATION

Statistics

		age	gender	Degree of myopia	IOP	Age groups
N	Valid	102	102	102	102	102
	Missing	4	4	4	4	4
Mean		40.01	1.46	1.81	18.6275	1.80
Std. Error of Mean		1.926	.050	.077	.34042	.068
Median		40.50	1.00	2.00	18.0000	2.00
Mode		50	1	1	16.00[a]	2
Std. Deviation		19.452	.501	.780	3.43806	.690
Variance		378.386	.251	.609	11.820	.476
Minimum		6	1	1	11.00	1
Maximum		75	2	3	25.00	3

a. Multiple modes exist. The smallest value is shown

Frequency Table

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	6	1	.9	1.0	1.0
	7	1	.9	1.0	2.0
	8	2	1.9	2.0	3.9
	9	1	.9	1.0	4.9
	10	2	1.9	2.0	6.9
	11	1	.9	1.0	7.8
	12	1	.9	1.0	8.8
	13	3	2.8	2.9	11.8
	14	2	1.9	2.0	13.7
	16	3	2.8	2.9	16.7
	17	2	1.9	2.0	18.6
	18	1	.9	1.0	19.6
	19	1	.9	1.0	20.6
	20	1	.9	1.0	21.6
	22	2	1.9	2.0	23.5

	24	1	.9	1.0	24.5
	25	2	1.9	2.0	26.5
	26	2	1.9	2.0	28.4
	27	2	1.9	2.0	30.4
	29	1	.9	1.0	31.4
	30	2	1.9	2.0	33.3
	31	3	2.8	2.9	36.3
	32	2	1.9	2.0	38.2
	33	3	2.8	2.9	41.2
	36	2	1.9	2.0	43.1
	37	1	.9	1.0	44.1
	39	2	1.9	2.0	46.1
	40	4	3.8	3.9	50.0
	41	2	1.9	2.0	52.0
	43	1	.9	1.0	52.9
	44	2	1.9	2.0	54.9
	45	1	.9	1.0	55.9

Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	46	1	.9	1.0	56.9
	47	3	2.8	2.9	59.8
	48	1	.9	1.0	60.8
	49	2	1.9	2.0	62.7
	50	7	6.6	6.9	69.6
	51	2	1.9	2.0	71.6
	52	1	.9	1.0	72.5
	53	5	4.7	4.9	77.5
	55	2	1.9	2.0	79.4
	56	1	.9	1.0	80.4
	57	2	1.9	2.0	82.4
	60	1	.9	1.0	83.3
	62	1	.9	1.0	84.3
	63	1	.9	1.0	85.3
	66	2	1.9	2.0	87.3
	67	3	2.8	2.9	90.2
	69	1	.9	1.0	91.2
	70	3	2.8	2.9	94.1
	73	4	3.8	3.9	98.0
	74	1	.9	1.0	99.0
	75	1	.9	1.0	100.0
	Total	102	96.2	100.0	

Missing	System	4	3.8		
Total		106	100.0		

gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	55	51.9	53.9	53.9
	Female	47	44.3	46.1	100.0
	Total	102	96.2	100.0	
Missing	System	4	3.8		
Total		106	100.0		

IOP

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	11.00	1	.9	1.0	1.0
	13.00	4	3.8	3.9	4.9
	14.00	7	6.6	6.9	11.8
	15.00	8	7.5	7.8	19.6
	16.00	12	11.3	11.8	31.4
	17.00	12	11.3	11.8	43.1
	18.00	9	8.5	8.8	52.0
	19.00	12	11.3	11.8	63.7
	20.00	4	3.8	3.9	67.6
	21.00	7	6.6	6.9	74.5
	22.00	4	3.8	3.9	78.4
	23.00	12	11.3	11.8	90.2
	24.00	8	7.5	7.8	98.0
	25.00	2	1.9	2.0	100.0
	Total	102	96.2	100.0	
Missing	System	4	3.8		
Total		106	100.0		

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Degree of myopia * gender	102	96.2%	4	3.8%	106	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.835[a]	2	.399
Likelihood Ratio	1.846	2	.397
Linear-by-Linear Association	1.466	1	.226
N of Valid Cases	102		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 10.60.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.134	.399
	Cramer's V	.134	.399
N of Valid Cases		102	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age groups * Degree of myopia	102	96.2%	4	3.8%	106	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	10.891[a]	4	.028
Likelihood Ratio	11.504	4	.021
Linear-by-Linear Association	7.975	1	.005
N of Valid Cases	102		

a. 1 cells (11.1%) have expected count less than 5. The minimum expected count is 3.61.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.327	.028
	Cramer's V	.231	.028
N of Valid Cases		102	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Chi square test varying degree of myopia with IOP to test for association

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
IOP * Degree of myopia	102	96.2%	4	3.8%	106	100.0%

IOP * Degree of myopia Cross tabulation						
			Degree of myopia			Total
			-0.50DS to -2.75DS	-3.00DS to -6.00DS	> -6,00DS	
IOP	11.00	Count	0	0	1	1
		Expected Count	.4	.4	.2	1.0
	13.00	Count	3	1	0	4
		Expected Count	1.6	1.5	.9	4.0
	14.00	Count	5	2	0	7
		Expected Count	2.9	2.5	1.6	7.0
	15.00	Count	4	3	1	8
		Expected Count	3.3	2.9	1.8	8.0
	16.00	Count	3	6	3	12
		Expected Count	4.9	4.4	2.7	12.0
	17.00	Count	4	4	4	12
		Expected Count	4.9	4.4	2.7	12.0
	18.00	Count	7	1	1	9
		Expected Count	3.7	3.3	2.0	9.0
	19.00	Count	3	5	4	12
		Expected Count	4.9	4.4	2.7	12.0
	20.00	Count	1	2	1	4
		Expected Count	1.6	1.5	.9	4.0
	21.00	Count	4	1	2	7
		Expected Count	2.9	2.5	1.6	7.0
	22.00	Count	1	3	0	4
		Expected Count	1.6	1.5	.9	4.0
	23.00	Count	3	5	4	12
		Expected Count	4.9	4.4	2.7	12.0
	24.00	Count	4	2	2	8
		Expected Count	3.3	2.9	1.8	8.0
	25.00	Count	0	2	0	2
		Expected Count	.8	.7	.5	2.0
Total		Count	42	37	23	102
		Expected Count	42.0	37.0	23.0	102.0

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	28.299[a]	26	.344
Likelihood Ratio	31.444	26	.212
Linear-by-Linear Association	1.492	1	.222
McNemar-Bowker Test	.	.	.[b]
N of Valid Cases	102		

a. 42 cells (100.0%) have expected count less than 5. The minimum expected count is .23.

b. Computed only for a PxP table, where P must be greater than 1.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.527	.344
	Cramer's V	.372	.344
	Contingency Coefficient	.466	.344
N of Valid Cases		102	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
IOP * Age groups	102	96.2%	4	3.8%	106	100.0%

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	16.567[a]	26	.922
Likelihood Ratio	18.312	26	.864

Linear-by-Linear Association	2.100	1	.147
N of Valid Cases	102		

a. 38 cells (90.5%) have expected count greater than 16 The minimum expected count is .16.

Symmetric Measures

		Value	Approx. Sig.
Nominal by Nominal	Phi	.403	.922
	Cramer's V	.285	.922
N of Valid Cases		102	

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.