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Prevalence and Risk Factors of Glaucoma Among Adults in Rural and Urban Communities of Ilorin West Local Government Area, North-Central Nigeria

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Abstract
Glaucoma is becoming an increasingly important cause of blindness, as the world's population ages. Glaucoma, however, presents perhaps an even greater public health challenge than cataracts; because the blindness it causes is irreversible. This study assessed the prevalence and risk factors of glaucoma among adults in rural and urban communities of Ilorin West Local Government Area, North-Central Nigeria. This was a cross-sectional comparative study. Respondents were selected through a Multi-stage sampling technique. Interviewer- administered structured questionnaire and clinical report form were used to collect data. Data was analyzed using SPSS version 15. Bivariate, correlation analysis and multivariate regression analyses were used to analyze data. Level of statistical significance was set at $p<0.05$. The prevalence of glaucoma was higher in the rural, 56 (12.4%), compared with the urban area, 37 (8.2%) with a p value of 0.037. Age of respondents, educational status, hypertension; and intra-ocular pressure, were found to be associated with glaucoma. However, the multivariate regression analysis identified only age and intra-ocular pressure as the two significant predictors of glaucoma in both the rural and urban areas of this study. The high prevalence of glaucoma obtained from this study attest to the high burden of glaucoma in the study communities. Regular community-based eye screening will be useful in early detection of glaucoma. In addition, government should make eye care services available at the primary health care centres at reduced cost to enhance geographical and financial access.

1. Introduction

Glaucoma is a group of optic neuropathy with characteristic visual field defect in

which age above 40 years; race and raised intraocular pressure (IOP) are risk factors.The term glaucoma encompasses a group of ophthalmic diseases that are believed to share the common patho-physiology of elevated intraocular pressure (IOP), or abnormal sensitivity to high-normal IOP, resulting in damage to the nerve fiber layer of the retina and irreversible visual loss. [1,2] The two most common forms of the disease are primary open angle glaucoma (POAG) and primary angle closure glaucoma (PACG), with variable patterns of disease prevalence in different ethnic groups.[2]

Glaucoma is a preventable cause of blindness.[1] In glaucoma, the intraocular pressure rises, and the first tissue to be damaged by this raised pressure is the optic nerve at the point where it enters the eye. [1,3] Glaucoma blindness cannot be cured, but if the disease is detected in its early stages, its progress can be arrested and in most cases the sight can be saved.[1]

Late diagnosis and inadequate treatment have been attributed as the major causes of blindness in glaucoma.[4] Published evidence indicates that late diagnosis of glaucoma is an important risk factor for subsequent blindness and is associated with poor knowledge about the condition.[4] Blindness constitutes a significant public health problem in many countries. Glaucoma is the second leading cause of blindness worldwide following cataract. [2,5,6,7-9] Projection has it that over 8.4 million people were bilaterally blind from glaucoma in 2010, and it was estimated that 12% of world blindness was due to glaucoma.[6]

Glaucoma affects 1 in 200 people aged fifty years and younger, and 1 in 10 over the age of eighty years. If the condition is detected early enough it is possible to arrest the development or slow the progression with medical and surgical means.[10]

The prevalence of glaucoma worldwide is estimated at almost 70 million people with over 6.7 million people bilaterally blind from glaucoma.[2,7,11] It repeatedly afflicted more than 66 million people in 2000, 10% of whom are now blind, and the rate will likely double in the next 15 years as the population ages.[12] In the United States, glaucoma is the second most common cause of blindness and the most common cause of blindness among African-Americans. About 6% of Americans have glaucoma, and only about fifty percent of those who have glaucoma know that they have it. Glaucoma is also estimated to affect 12 million Indians; it causes 12.8% of the total blindness in the country and is considered to be the third most common cause of blindness in India. In a survey in Ilorin, Nigeria, by Mahmoud *et al*, the prevalence of blindness was found to be 3.4% and the major causes of blindness were glaucoma (40%), cataract (34.3%) and onchocerciasis (11%).Another prevalence study in Nigeria revealed that glaucoma is one of the leading causes of blindness, accounting for 19.8% of the blindness.[13]

Blindness and visual impairment have far-reaching implications for society, more so when it is realized that 80% of visual disability is avoidable. The marked increase in the size of the elderly population, with their greater propensity for visual disabling conditions, presents a further challenge in this respect. However, if available knowledge and skills were made accessible to those communities in greatest need, much of this needless blindness could be alleviated through glaucoma surveys.[14]

2. Methodology

Ilorin West LGA is a premier LGA and one of the sixteen LGA that makes up Kwara State of Nigeria. Ilorin West LGA is bounded in the North by Moro LGA, in the South by Asa LGA and in the east by Ilorin East LGA.Ilorin West LGA has a land mass of 54.2 square kilometers and it is located between latitude $8^0$10' and longitude $4^0$35'. It is situated in the transitional zone between northern and southern parts of Nigeria.

The Local Government is made up of 12 political wards viz:-Ajikobi, Ubandawaki, Adewole, Wara/Osin/Egbejila, Magaji-Ngeri, Oko-erin, Badari, Oloje and Baboko, Ogidi, Alanamu and Ojuekun/Sarumi wards. Ilorin west LGA has aprojected population of 441,198.[15] The current total population of adults (40 years and above) in Ilorin West LGA based on projection from 2006 census is 85,424.[15] Ilorin west LGA has four rural communities which are Wara-Oja, Egbejila, Osin and Ogundele communities located in the Wara/Osin/Egbejila ward.

The inhabitants of Ilorin West are indigenous people with strong cultural ties. The community is a confluence of cultures populated by inhabitants that speak different languages which include Yoruba, Fulani, Nupe, Igbo and Hausa. The heterogeneous people that constitute this community could be traced to the historical background of Ilorin emirate.

Certain socio-cultural practices that are commonly practiced among the people include facial scarification. In addition, the use of traditional eye medications is also a common practice among the people as some inhabitants often consult a traditional healer before presenting to the hospital. This is apart from the practice of self-medication and belief in supernatural forces as the cause of blindness thus preventing early presentation to the hospital. These patronized traditional healers tend to prefer the use of concoctions that cause irritation and pain because this is perceived as being potent. Some of the substances often used may be acidic or alkaline resulting in ocular burns. Worse still, no particular attention is paid to the content, concentration and mode of action as most of these concoctions are made, without recourse to hygiene, using contaminated water, local gin, saliva and even urine. Poverty, poor health seeking behavior, socio-cultural beliefs, and lack of access to specialized eye care services/health facilities are some of the common reasons for the persistence of this practice among the people of Ilorin West LGA. The increasing worldwide interest in the use of herbal medicines

could also be a factor.

Ilorin West LGA has a total of 20 public health facilities. This comprised two cottage hospitals, one General hospital owned by the Kwara State government, while the remaining 17 owned by the Local Government are a comprehensive health centre and 16 primary health centres. There is no specialized eye care service rendered in any of these hospitals, except the General hospital where there is a Consultant Ophthalmologist. Five of these health centres, one in each of the chosen rural and urban communities will be used as fixed post for the ophthalmological examination/screening. However, there are a few health centres located outside the Ilorin West Local Government Area where specialized eye care services can be accessed. These are the Kwara State Specialist Hospital, the Civil service clinic and the University of Ilorin Teaching Hospital.

This was a cross-sectional comparative study. The study populations were adult men and women in the selected/study communities- four rural and one urban- of Ilorin West LGA. The exclusion criteria used were age below 40 years, previous history of ocular surgery; visitors to the selected communities; those with red eye or other acute eye infection (e.g conjunctivitis regardless of the cause) because the dilating agent for fundoscopy may worsen the symptoms; and adults with cornea or media opacity as it makes the fundus inaccessible/invisible.

The minimum sample size for the study was determined using the formula for comparative study when comparing the mean (intra-ocular pressure in rural μ_1 and urban μ_0 communities) of two independent groups. A total sample size of 300 (inclusive of 10% non response) was obtained for each of rural and urban area However, because of the use of cluster design, a design factor of 1.5 was used to give 450 each for rural and urban area making an overall total of 900.

Multi-stage sampling technique with four stages was used. Simple random sampling technique by balloting was used to select one urban ward out of the 11 urban wards in Ilorin West LGA. Alanamu ward was selected. However, the only rural ward (Wara/Osin/Egbejila) was used in the study. Therefore, a rural and an urban ward were used for the study.

Simple random sampling technique by balloting was used to choose a community from the three urban communities (Balogun Alanamu, Adabata and Isale-Aluko) that made up the selected urban ward. Alanamu community was randomly selected as the urban community. However, all the four (Wara-oja, Osin, Egbejila and Ogundele) communities in the only rural ward were used. In all, a total of five communities were used for the study.

Household enumeration was conducted to know the number of households in all the five communities. The households in each community were delineated into enumeration areas (EAs). Each enumeration area demarcation has a cluster of 44 households.Alanamu community has a total of 38 EAs; Wara-osin 2EAs; Egbejila 3EAs; Osin-Aremu 4EAs while Ogundele has 2EAs. A total of 30 EAs were randomly selected from the 38 EAs in the urban community chosen. However, all the 11 EAs in the rural communities were selected.

Cluster sampling technique was used to select the required number of respondents across the chosen enumeration areas. Each enumeration area was regarded as a cluster and all eligible and willing respondents in the households within the selected enumeration areas were recruited for the study until the required sample size of 450 each was attained for both the rural and urban communities. For households within an enumerations area where eligible respondents were not willing to participate or where there were no eligible respondent, the next household was visited to recruit subject.

Four research assistants were trained to participate in the study. The questionnaire was translated into the local language (Yoruba) for easy interpretation and back translated into English language. The intra-ocular pressure was measured using the Goldmann standard Perkins (hand-held) applanation tonometre (Haag-Streit^R), applanation prism, local anaesthetic drops, fluorescein strips and clean cotton wool or gauze swabs. Fundoscopy was done through the use of the ophthalmoscope. The light reflection in the examination room was lowered and respondents who are using glasses were asked to remove them. A multi-letter Snellen chart or E chart (for respondents with no formal education) was used to assess the respondents' visual acuity.

The questionnaire was pre-tested in Okelele community, another community located in Ilorin East LGA with a view to detect deficiencies or ambiguities in the questionnaire. Bivariate and Multivariate analysis were used to analyze data. Ethical approval for the study was obtained from the research and ethical committee of the University of Ilorin Teaching Hospital. Informed consent was obtained, signed or with a thumb print from the study subjects and the nature of the research was explained. Anonymity and confidentiality of results of the respondents was ensured. The respondents with abnormal intra-ocular pressure and or fundoscopy results were referred to Consultant Ophthalmologists for further assessment. All the referred respondents were properly tracked to ensure that they received the required treatment.

3. Diagnostic Criteria for Glaucoma

Intra-Ocular Pressure- Values > 21mmHg; a difference of 4mmHg or more between the two eyes was considered as abnormal.Low or Normal IOP with visual field defect was regarded as normal tension glaucoma. High IOP with normal disc will be classified as Ocular Hypertension.[16]

Optic disc status- CDR (Cup-Disc Ratio) > 0.5. When there is evidence of glaucomatous optic nerve damage, that is, cupping of > 0.5. However, if there was no such evidence, the subject was classified as non-glaucomatous. [16]

Visual fields- Subjects with visual field defects suggestive of glaucoma was regarded as having glaucoma if there is either glaucomatous optic disc changes or high IOP.[16]

4. Results

As shown in Table 1, older respondents (≥60years) were

slightly higher in the rural communities, 168 (37.3%), compared with the urban area where they made up 157 (34.8%).This observed difference in the age composition between the rural and urban areas, was however, not statistically significant (p=0.361). While more than three-quarters of the respondents in both rural, 430 (95.6%), and urban, 412 (91.6%), communities were Moslems, Christianity accounted for less than one-tenth of the respondents in each of the rural and urban areas. This observed difference was found to be statistically significant with a p value of 0.020.

Table 2 showed that respondents with high intra-ocular pressure (>21.0mmHg) were more in the urban, 36 (8.0%), compared with the rural areas which has a total of 25 (5.5%). Similarly, those who had intra-ocular pressure within the normal range (10-21mmHg) were more in the rural, 385 (85.6%) than the urban, 402 (90.2%) areas. This observed difference was statistically significant (p= 0.0001).

As seen in Table 3, blindness was more among the urban respondents. The overall prevalence of blindness was higher in the urban, 6.2% (95%CI=3.9-8.4%) compared with the rural, 1.2% (95%CI= 0.2-2.2%), areas of this study (p= 0.0001).

In Table 4, a total of 56{(12.4%; (95%CI 9.4%-15.4%)} of the respondents in the rural areas were assessed/screened to have glaucoma compared with 37{(8.2%; (95%CI 5.7%-10.7%)} of the urban respondents. The observed difference was statistically significant with a p value of 0.037.In both the rural and urban areas, the age-group 60-69 years had the highest prevalence of glaucoma.

In Table 5, older respondents with glaucoma were more in the urban area compared with the rural area (p= 0.035).

Table 1. *Socio-demographic characteristics of the Respondents.*

Variable	Rural N=450 n (%)	Urban N=450 n (%)	χ^2	p value
Age (years)				
40-49	185 (41.1)	178 (39.6)		
50-59	97 (21.6)	115 (25.6)	2.0	0.361
≥60	168 (37.3)	157 (34.8)		
Mean=	53.6±11.7	54.3±11.6	t=-0.9	0.336
Gender				
Male	133 (29.6)	110 (24.4)		
Female	317 (70.4)	340 (75.6)	2.9	0.098
Marital status				
Married	329 (73.1)	309 (68.7)		
Widowed	96 (21.3)	108 (24.0)		
Single	17 (3.8)	20 (4.4)	3.9	0.418
Divorced	6 (1.3)	12 (2.7)		
Separated	2 (0.5)	1 (0.2)		
Level of Education				
No formal education	308 (68.4)	176 (39.1)		
Primary	61 (13.6)	30 (6.7)		
Secondary	52 (11.6)	46 (10.2)		
Tertiary	29 (6.4)	198 (25.2)	172.8	0.0001
Tribe				
Yoruba	435 (96.7)	438 (97.3)		
Hausa/Fulani	12 (2.7)	4 (0.9)	6.3	0.043
Igbo	3 (0.6)	8 (1.8)		
Religion				
Islam	430 (95.6)	412 (91.6)		
Christianity	20 (4.4)	38 (8.4)	5.9	0.020
Occupation				
Trading	258 (57.3)	171 (38.0)		
Civil servant	47 (10.4)	185 (41.1)		
Artisans/Farming	112 (24.9)	14 (3.1)	195.8	0.0001
Housewife	4 (0.9)	7 (1.6)		
Unemployed	29 (6.5)	73 (16.2)		
Average Monthly Income(₦)				
≤20,000	290 (64.5)	205 (45.6)		
21,000-40,000	64 (14.2)	64 (14.2)	40.7	0.0001
≥41,000	96 (21.3)	181 (40.2)		
	Median income-	₦15,000	₦25,000	

Table 2. *Intraocular Pressure (IOP) and Cup-Disc Ratio (CDR) of the respondents.*

IOP(mmHg)	Rural N=450n (%)	Urban N=450n (%)	χ2	p value
Low (<10.0)	40 (8.9)	8 (1.8)		
Normal (10.0-21.0)	385 (85.6)	406 (90.2)	23.9	0.0001
High (>21.0)	25 (5.5)	36 (8.0)		
Mean	13.9±3.9	15.5±8.5	t= -5.3	0.0001
Right Eye (RE)				
Low (<10.0)	31 (6.9)	8 (1.8)		
Normal (10.0-21.0)	397 (88.2)	410 (91.1)	15.6	0.0001
High (>21.0)	22 (4.9)	32 (7.1)		
Left Eye (LE)				
Low (<10.0)	26 (5.8)	8 (1.8)		
Normal (10.0-21.0)	396 (88.0)	402 (89.3)	11.7	0.003
High (>21.0)	28 (6.2)	40 (8.9)		
Difference (RE-LE)				
Normal (<4.0)	412 (91.6)	405 (90.0)		
Abnormal (≥4.0)	38 (8.4)	45 (10.0)	0.7	0.419
CDR				
Normal (≤0.5)	447 (99.3)	449 (99.7)		
Abnormal (>0.5)	3 (0.7)	1 (0.3)	1.0	0.624
Cup-Disc Ratio(CDR)				
RE				
Normal (≤0.5)	367 (81.6)	382 (84.9)		
Abnormal (>0.5)	83 (18.4)	68 (15.1)	1.8	0.180
Cup-Disc Ratio (CDR)				
LE				
Normal (≤0.5)	377 (83.8)	382 (84.9)		
Abnormal (>0.5)	73 (16.2)	68 (15.1)	0.2	0.647

Table 3. *Distribution of Visual Acuity, Visual Field, Blindness and Prevalence of Glaucoma among respondents in Rural and Urban area.*

VariableVisual Acuity	Rural N=450 n (%)	Urban N=450 n (%)		p value
One eye normal	49 (10.9)	18 (4.0)		
Both eyes normal	309 (68.7)	286 (63.6)		
Both eyes abnormal	92 (20.4)	146 (32.4)		0.0001
Better Eye				
Normal vision	360 (80.0)	304 (67.6)		
Abnormal vision	90 (20.0)	146 (32.4)		0.0001
Visual Field				
Defective	173 (38.4)	49 (10.9)		
Not defective	277 (61.6)	401 (89.1)		0.0001
Blindness				
2/60	1 (0.2)	23 (5.1)		
1/60	2 (0.4)	5 (1.1)		
HM	1 (0.2)	0 (0.0)		0.0001
CF	2 (0.4)	0 (0.0)		
Glaucoma screening				
Glaucoma	56(12.4)	37(8.2)		
No glaucoma	394(87.6)	413(91.8)	4.3	0.037
φ=0.069; OR=1.6 (1.0-2.5)*				
Lateralization of Glaucoma	N=56	N=37		
Unilateral	40 (71.4)	28 (75.7)		
Bilateral	16 (28.6)	9 (24.3)	0.2	0.831**
OR=0.8 (0.3-2.3)*				
Assessment indices/Criteria	N=56	N=37		
Abnormal IOP+ Diff ≥4mmHg	22 (39.3)	18 (48.7)		
Normal Tension glaucoma	11 (19.6)	3 (8.1)		
Ocular hypertension	6 (10.7)	2 (5.4)		
Glaucomatous disc(CDR>0.5)	3 (5.4)	1 (2.7)		
VF defect+ CDR >0.5	10 (17.9)	12 (32.4)		
VF defect+ High IOP	4 (7.1)	1 (2.7)	6.3	0.274

φ=phi co-efficient; OR=Odds ratio; **Yates correction; HM=hand movement; CF count finger

Table 4. *Distribution and different types of glaucoma among age groups of respondents.*

Age group (years)	Rural N=450		Urban N=450	
	No of cases	Prevalence (95%CI)	No of cases	Prevalence (95%CI)
40-49	14	3.1 (1.5-4.7)	7	1.6 (0.4-2.8)
50-59	10	2.2 (0.8-3.6)	2	0.4 (-0.2-0.9)
60-69	17	3.8 (2.0-5.6)	10	2.2 (0.8-3.6)
70-79	12	2.6 (-2.1-7.3)	9	2.0 (0.7-3.3)
80-89	3	0.7 (-0.07-1.5)	9	2.0 (0.7-3.3)
Total	56	12.4	37	8.2
χ^2= 9.4;df= 4; p = 0.051				
Types of glaucoma	N=56		N= 37	
POAG(76.8)	43	9.6 (6.9-12.3)	31 (83.8)	6.9 (4.6-9.2)
PACG(23.2)	13	2.8 (1.3-4.3)	6 (16.2)	1.3 (0.8-2.4)
χ^2= 0.7; df= 1;p = 0.412				

POAG= Primary Open Angle Glaucoma; PACG=Primary Angle Closure Glaucoma

Table 5. *Factors associated with presence of glaucoma among rural and urban respondents.*

Variable	Glaucoma				
	Rural N=56	Urban N=37			
	Yes (%)	Yes (%)	χ2	df	p value
Age (years)					
40-59	24 (42.9)	8 (21.6)			
≥60	32 (57.1)	29 (78.4)	4.5	1	0.035
Educational status					
No formal education	40 (71.4)	18 (48.7)			
Formal education	16 (28.6)	19 (51.3)	4.9	1	0.027
Gender					
Male	17 (30.4)	21 (56.8)			
Female	39 (69.6)	16 (43.2)	6.4	1	0.011
Occupation					
Employed	55 (98.2)	24 (64.9)			
Unemployed	1 (1.8)	13 (35.1)	21.4	1	0.000004
IOP(mmHg)					
Low/Normal (≤21)	31 (55.4)	12 (32.4)			
High (>21)	25 (44.6)	25 (67.6)	4.7	1	0.029
Known Diabetic					
Yes	9 (16.1)	8 (21.6)			
No	47 (83.9)	29 (78.4)	0.5	1	0.498
Known Hypertensive					
Yes	19 (33.9)	25 (67.6)			
No	37 (66.1)	12 (32.4)	10.1	1	0.002
Prolonged analgesic					
Yes	38 (67.9)	14 (37.8)			
No	18 (32.1)	23 (62.2)	8.1	1	0.004

The Multivariate regression analysis showed only age and intra-ocular pressure as the two significant predictors common to both rural and urban areas as shown in Table 6.

Table 6. *Regression Analysis showing the predictors of glaucoma in rural and urban areas*

Variables	RURAL				URBAN			
	β	SE	Exp β	p value	β	SE	Exp β	p value
Age	-0.046	0.018	0.955	0.01	-0.093	0.02	0.912	0.0001
IOP	-0.332	0.051	0.718	0.0001	-0.039	0.02	0.962	0.048
Gender	0.115	0.464	1.122	0.804	-2.329	0.519	0.097	0.0001

IOP= Intra-ocular pressure

5. Discussion

In this study, the mean age of the respondents in the urban area (54.3±11.6) was slightly higher than that of the rural area (53.6±11.7), but the difference was however, not significant mainly because the study targeted similar age groups in the two areas. This can also be explained by the increasing movement of active population into the urban area in search of jobs and better conditions of living. This movement of the rural population into the urban areas causes urbanization; a number of the adults/elderly prefer to stay in the urban areas as compared to the previous norm where they do relocate to the village after retirement or attaining a prescribed age.

Also, apart from the fact that this study targeted adult men and women, Ilorin west Local Government Area is predominantly an urban Local Government with vast commercial activity involving active/adult population. However, in this study, those who are 60 years and above were found to just be slightly more in the rural area compared with the urban area. This is to be expected as the erstwhile norm of elderly retiring to the villages to spend the rest of their lives after having worked to earn a living in the urban areas of the society for the most of their lives still subsists to some extent.

Age was found to have association with the presence of glaucoma as higher proportion of older respondents compared with the younger respondents had glaucomatous eyes in both rural and urban areas. This was similar to the findings in a study among the Chinese and Indian populations where the prevalence of glaucoma was found to increase with age.[8,17] This was also the finding of Ramakrishnan *et al* in a study among a rural population of southern India.[18] Ageing process is associated with a lot of anatomical and physiologic changes that involves virtually all parts of the body including the eyes (which may be glaucomatous changes). Again, probable accumulated exposure to ocular risk factors over several decades may also be responsible for this association between older age and glaucoma. Besides, the intra-ocular pressure has been shown to increase with age and progressively increasing intra-ocular pressure is a precursor for glaucomatous changes in the eyes.

Also, the female respondents in this study were found to be more than the males in both the rural and urban communities, but the difference was not significant (p=0.098). Specifically, females accounted for 70.4% and 75.6% of the respondents in both the rural and urban communities respectively. In this part of the society, it is socio-cultural for men to go out and fend for their families while the women remain at home to take care of the children; and this study was a household survey with a preventive/screening aspect. More so, women have been found to be involved more in preventive/diagnostic health measures than the men. [19]These findings were also similar to that of Abdulraheem *et al* in a study among the elderly in Borno State, Nigeria where the women were more than the men in the rural community studied. [20] In this study, rural females had glaucoma more than their male counterparts, but this was not so in the urban area, where the males had glaucoma more than the females. The males, expectedly, are the ones that vend for the family, does the running around which in the process exposes them to quite a number of risk factors including ocular trauma. Besides, there is a greater willingness among women to use healthcare services and report health problems which can be remedied on time. Specifically, women over-report minor health problems or present health problems at an earlier, more benign state. [21] This was equally buttressed in this study as more females than males participated in both the rural and urban areas. This was similar to the findings in India where male gender was also found to be associated with glaucoma. In a study on ocular health status in a rural community of Southwest Nigeria, Adegbehingbe *et al* found that more than half of the males had ocular morbidities of which glaucoma constituted 21.1%.[22] Expectedly, more than two thirds of the rural respondents in this study had no formal education compared with just about one-third among the urban subjects; however, about a quarter of the urban respondents had tertiary education. This is a reflection of the literacy rate in most of the rural areas in the country where there is little or no access to formal education as compared with the urban areas. More educational facilities are concentrated in the urban compared with rural areas therefore people in urban communities probably had more opportunities for formal education. [23] This low literacy rate will have effect on the health-seeking behaviour of the rural subjects as they may not consider routine eye examination as being important and may even trivialize important health/ocular condition. Consequently, in this study, more than three-quarters of the rural respondents with no formal education had glaucoma compared with less than half among the urban respondents and this was significant.

Majority of the subjects in both rural and urban communities had intra-ocular pressure that fell within the normal reference range of 10-21mmHg. However, more of the urban compared with the rural respondents had intra-ocular pressure that were found to be abnormal (>21mmHg) and this difference was statistically significant (p= 0.0001). Similarly, the mean intra-ocular pressure was also higher in the urban compared with the rural communities and this difference was statistically significant. Similar finding was also found in the Namil study, South Korea where the mean IOP of subjects from the urban area was significantly higher than that of those from then rural area (14.45±2.67mmHg vs 13.53±2.76mmHg, $p<0.05$). [24] These ophthalmological findings seen in the urban areas of this study may be due to the fact that exposure to risk factors of glaucoma was much more than what was obtained in the rural areas. It could also be due to the fact the mean age of respondents in the urban area was found to be higher than that of the rural respondents which suggest a slightly older population. On its association with glaucoma, a higher proportion of urban respondents with high intra-ocular pressure compared with the rural subjects had glaucoma and this difference was significant.

Hypertensive respondents with glaucoma were more in the urban area compared with the rural area in this study and the difference was statistically significant. This may be possible as a number of the hypertensive subjects may have their blood pressure poorly controlled, thereby causing progressive damage in the eyes. Hypertension and Diabetes mellitus have also been found to have association with elevated intra-ocular pressure (IOP) in a study by Sakata and Maia *et al* in Brazil where it was found that IOP values increases progressively from the hypertensive patients without retinopathy, to the hypertensive with retinopathy and diabetic-hypertensive with retinopathy.[25] The results of the Barbados Eye study also showed that IOP increase is related to systemic arterial blood pressure.[26] Similarly, in a case-control studyin

Birmingham, United Kingdom, hypertension was significantly more common in the 27, 080 patients with glaucoma than in the controls.[27]

6. Conclusions

With the proportion of respondents with evidence of glaucoma obtained in this study, it suffices to say that the burden of glaucoma is assuming a worrisome dimension in the study area. The prevalence of glaucoma was found to be higher in the rural (12.4%) compared with the urban (8.2%) area. However, blindness (Visual acuity <3/60 in the better eye) was found to be more in the urban compared with the rural area with a prevalence of 6.2% and 1.2% for urban and rural areas respectively.A number of risk factors were found to be associated with glaucoma among the respondents in this study. These included age, intra-ocular pressure, gender, systemic hypertension among others

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