

**MAGNITUDE, PATTERN AND LEVEL OF AWARENESS  
OF DIABETIC RETINOPATHY AT KORLE-BU TEACHING  
HOSPITAL ACCRA-GHANA**

*A DISSERTATION SUBMITTED IN PART FULFILLMENT FOR THE  
DEGREE OF MASTER OF MEDICINE IN OPHTHALMOLOGY,  
UNIVERSITY OF NAIROBI*

**BY**

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**2011**

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## DECLARATION

This dissertation is my original work and has not been presented in any other forum.

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## **DEDICATION**

To my loving parents for their continued support and encouragement especially my mother my fortress.

To a Great wonderful, exemplary doctor my role model, this personality has always stood by me in good and bad times.

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## LIST OF ABBREVIATION

|        |   |
|--------|---|
| BCVA   | Best Corrected visual Acuity                          |
| BP     | Blood pressure  |
| CI     | Confidence Interval                                   |
| CSME   | Clinically significant macular oedema                 |
| CURES  | Chennai Urban Rural Epidemiology Study                |
| DCCT   | Diabetes Control and complication Trial               |
| DM     | Diabetes Mellitus                                     |
| DR     | Diabetic Retinopathy                                  |
| DRS    | Diabetic Retinopathy Study                            |
| EDTRS  | Early Treatment Diabetic Retinopathy Study            |
| FBS    | Fasting Blood sugar                                   |
| HbA1c  | Glycosylated haemoglobin                              |
| HRPDR  | High Risk proliferative Diabetic Retinopathy          |
| ID     | International dollar                                  |
| IDF    | International Diabetes Federation                     |
| IDDM   | Insulin Dependent Diabetes Mellitus                   |
| IFG    | Impaired Fasting Glucose                              |
| IGT    | Impaired Glucose Tolerance test                       |
| IQR    | Interquartile range                                   |
| NCDs   | Non communicable diseases                             |
| NHRPDR | Non High Risk Proliferative Diabetic Retinopathy      |
| NVD    | Neovascularisation at the disc                        |
| OHA    | Oral Hypoglycaemic Agents                             |
| PDR    | Proliferative Diabetic Retinopathy                    |
| SPSS   | Stastical package for Social Science                  |
| UKPDS  | United kingdom Prospective Diabetic Study             |
| USD    | United States Dollars                                 |
| WESDR  | Wisconsin Epidemiologic Study of Diabetic Retinopathy |
| WHO    | World Health Organization                             |

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## ABSTRACT

**Purpose:** To determine the magnitude, pattern and level of awareness of diabetic retinopathy among patients with diabetes mellitus at the Korle-Bu Teaching Hospital, Accra-Ghana.

**Methods:** This was a hospital based cross-sectional analytical study, conducted on diabetic patients attending Korle-Bu Teaching Hospital. Participants were referred from the diabetic centre and other departments who consented to the study. Visual acuity was assessed with the use of Snellen's chart. They were assessed for diabetic retinopathy using stereoscopic biomicroscopy with a 90D and 20D loupe. Diabetic retinopathy was clinically graded using Early Treatment Diabetic Retinopathy Study Guidelines. Blood pressure, fasting blood sugar and HbA1c were measured. Level of awareness about diabetes mellitus and its effect on the retina was assessed. Data was recorded in a questionnaire and analyzed using SPSS Version 16.0. A significance level of 95% was used.

**Results:** Of the 313 participants examined, (204 were females and 104 males) with a mean age of 55.3years. Their age range was from 22 to 82 years. Prevalence of diabetic retinopathy was found to be 49.0%. Non proliferative diabetic retinopathy (NPDR) with clinically significant macula oedema (CSME) was found in 44 participants (14.1%), while severe non proliferative diabetic retinopathy was found in 3 patients (1.0%). High risk proliferative diabetic retinopathy (HRPDR) was found in 12 participants (3.8%) and vision threatening retinopathy (HRPDR) not amenable to photocoagulation was found in 11 participants (3.5%). Diabetic retinopathy was associated with long duration of diabetes, high blood pressure, high FBS and HbA1c. Awareness that diabetes mellitus affects the eyes was found to be 76.0%. However only 61 patients (19.5%)

knew that diabetic retinopathy is a complication of diabetes mellitus. Type 2 diabetes was found in 305 patients (97.0%), while 8 patients (3.0%) had type 1 DM. Majority of patients had seen an “eye doctor (90.7%) but only 1/3 had had eye examination.

**Conclusion:** NPDR with CSME was found in most of the participants. Majority did not know about diabetic retinopathy (Diabetic eye disease).

**Recommendation:** There is the need for awareness creation among diabetics on diabetic eye disease.

## 1.0 INTRODUCTION

Worldwide, the prevalence of diabetes and diabetic retinopathy is increasing at an alarming proportion and Ghana is no exception. The prevalence worldwide of diabetes is estimated at 6%.<sup>1</sup> Currently, it is a priority area for the vision 2020 program.<sup>2</sup>

Wild et al has predicted that 366 million people will have diabetes by the year 2030.<sup>3</sup> Data on diabetes and diabetic retinopathy in Ghana is scanty. Recent studies showed 6.3% crude prevalence of diabetes.<sup>4</sup> From anecdotal observations, it has been noted that patients diagnosed with diabetes mellitus presenting to the Korle-Bu Teaching Hospital Eye-Unit arrived with advanced retinopathy.

In virtually every prevalence study of diabetic retinopathy, duration of diabetes is the most important characteristic associated with increased risk.<sup>5</sup> Diabetic retinopathy is a non-communicable, hereditary disease with no early warning signs. While the occurrence of diabetic retinopathy cannot be prevented, with provision of knowledge to sufferers, sight-threatening complications can be minimized.<sup>6,7</sup>

For working aged persons in the United States of America 21-64years, the federal budgetary cost of one person-year of blindness has been estimated at \$11,896. Economic evaluation indicate that screening for diabetic retinopathy cost less than one person year of blindness.<sup>8</sup>

In Ghana the National Health Insurance Scheme spends on an average 2,500-5000USD per annum per diabetic and the cost is expected to be much higher for diabetic retinopathy. The few treatment facilities for diabetic retinopathy are in the urban centers and expensive. The cost of laser treatment is 100USD per eye as per the Korle-Bu Teaching Hospital Eye-unit price list.

Increased levels of awareness may lead to uptake of eye care services hence early detection and treatment that will prevent or slow progression of visual impairment and resultant blindness.<sup>9,10</sup>

The aim of this study was to determine the magnitude, pattern and current level of awareness of diabetic retinopathy among diabetic patients and its associations with duration of diabetes, blood pressure, glycaemic control and type of diabetes among diabetic patients at the Korle-Bu Teaching Hospital in Accra–Ghana.

## **1.1 Diabetes mellitus and Diabetic retinopathy**

Diabetes is a syndrome of chronic hyperglycaemia due to relative insulin deficiency, resistance or both. Diabetic retinopathy is a complication of diabetes mellitus and leading cause of blindness.<sup>11</sup> The two broad categories of diabetes mellitus are designated type 1 and type 2.<sup>12</sup>

In terms of type of diabetes mellitus, those with type I diabetes have predominantly proliferative diabetic retinopathy and those with type II tend to develop macular oedema.<sup>13</sup>

## **1.2 Epidemiology**

### **1.2.1 Diabetes Mellitus**

It affects more than 120 million people worldwide and is estimated that it will affect 220 million by the year 2020. Diabetes mellitus is usually irreversible and although patients can have reasonably normal lifestyle, its late complication result in reduced life expectancy and major health costs.<sup>11</sup> The prevalence of type 2 diabetes mellitus is expected to rise more rapidly in future because of increasing obesity and reduced activity. Diabetes mellitus increases with aging.<sup>12</sup> The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between the year 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people >65 years of age.<sup>3</sup> An estimated 285 million people, corresponding to 6.4% of the world's adult population, will live with diabetes in 2010. The number is expected to grow to 438 million by

2030, corresponding to 7.8% of the adult population. Far the highest increases in prevalence will happen in developing countries and this only confirms that diabetes is a disease associated with poverty.<sup>14</sup>

While the global prevalence of diabetes is 6.4%, the prevalence varies from 10.2% in the Western Pacific to 3.8% in the African region. However, the African region is expected to experience the highest increase. With an estimated 50.8 million people living with diabetes, India has the world's largest diabetes population, followed by China with 43.2 million. The largest age group currently affected by diabetes is between 40-59 years. By 2030 this “record” is expected to move to the 60-79 age groups with some 196 million cases. Diabetes is one of the major causes of premature illness and death worldwide. Non-communicable diseases including diabetes account for 60% of all deaths worldwide.<sup>14</sup>

### **1.2.2 The Burden of Diabetes in Developing Countries**

The major burden of the disease is borne by the low and middle-income countries and it disproportionately affects the lower socio-economic groups, the disadvantaged and the minorities in the richer countries.<sup>14</sup> Diabetes is slowly emerging as an infectious disease that is affecting low income countries especially Sub-Saharan Africa and this trend is just adding onto the already existing burden.

### **1.2.3 Lack of sufficient diagnosis and treatment.**

In developing countries, less than half of people with diabetes are diagnosed. Without timely diagnoses and adequate treatment, complications and morbidity from diabetes rise exponentially. Type 2 diabetes can remain undetected for many years and the diagnosis is often made from associated complications or incidentally through an abnormal blood or urine glucose test.

Undiagnosed diabetes accounted for 85% of those with diabetes in studies from South Africa, 80% in Cameroun, 70% in Ghana and over 80% in Tanzania.<sup>14</sup> The number of deaths attributable to diabetes in 2010 shows a 5.5 % increase over the estimates for the year 2007.<sup>14</sup> This increase is largely due to a 29 % increase in the number of deaths due to diabetes in North America and Caribbean Region, a 12 % increase in the South East Asia Region and an 11% increase in the Western Pacific Region.<sup>14</sup> Type 2 diabetes is responsible for 85-95% of all diabetes in high-income countries and may account for an even higher percentage in low and middle-income countries.<sup>14</sup> Type 2 diabetes (80%) is preventable by changing diet, increasing physical activity and improving the living environment.<sup>14</sup> Without effective prevention and control programmes ,the incidence of diabetes is likely to continue rising globally. Insulin is vital for the survival of people with type 1 diabetes and often ultimately required by people with type 2 diabetes.<sup>14</sup> Even though insulin's indispensable nature is recognized by its inclusion in the WHO's essential medicines list, insulin is still not available on regular basis in many parts of the developing world.<sup>14</sup>

#### **1.2.4 Diabetes costs - a burden for families and society.**

The financial burden borne by people with diabetes and their families as a result of their disease depends on their economic status and the social insurance policies of their countries. In the poorest countries, people with diabetes and their families bear almost the whole cost of medical care.<sup>14</sup> In Latin America, families pay 40-60% of medical care expenditures from their own pockets.<sup>14</sup> In Mozambique, diabetes care for one person requires 75% of the per capita income; in Mali it amounts to 61%; Vietnam is 51% and Zambia 21% expressed in International Dollars (ID),<sup>14</sup> which correct for differences in purchasing power, estimated global expenditures on diabetes will be at least ID 418 billion in 2010, and at least ID 561 billion in 2030.<sup>14</sup> An



estimated average of ID 878 per person would be spent on diabetes in 2010 globally. Besides excess healthcare expenditure, diabetes also imposes large economic burden in the form of lost productivity and foregone economic growth.<sup>14</sup> The largest economic burden is the monetary value associated with disability and loss of life as a result of the disease itself and its related complications.<sup>14</sup> The World Health Organization (WHO) predicted net losses in national income from diabetes and cardiovascular disease of ID 557.7 billion in China, ID 303.2 billion in the Russian Federation, ID 336.6 billion in India, ID 49.2 billion in Brazil and ID 2.5 billion in Tanzania (2005 ID), between 2005 and 2015.<sup>14</sup> Unless addressed, the mortality and disease burden from diabetes and other non-communicable diseases will continue to increase. WHO projects that globally, deaths caused by these health problems will increase by 17% over the next decade, with the greatest increase in low – middle income countries, mainly in the African (27%) and Eastern Mediterranean (25%) regions.<sup>14</sup>

### **1.2.5 Diabetic Retinopathy**

Diabetic retinopathy has no early warning signs or may cause mild vision problems; however, diabetic retinopathy can result in blindness. To reduce the cases of blindness due to diabetes, early detection is important. Patient education and affordable eye care can make this possible.<sup>6</sup>

WHO has estimated that diabetic retinopathy is responsible for 4.8% of the 37 million cases of blindness throughout the world.<sup>15</sup>

Worldwide, several studies on the prevalence of diabetic retinopathy have been carried out. Population based studies tend to show lower prevalence compared to hospital based studies. In Australia, the Australian diabetes, obesity and lifestyle study (Ausdiab, 2003) reported a prevalence of 15.3%,<sup>16</sup> while in India, the Chennai urban rural epidemiological study (CURES 1, 2005) reported a prevalence of 17.6%.<sup>17</sup>

In the African set up, mainly hospital based studies have been carried out. Kariuki et al found a prevalence of 49.8% in black African attending Kenyatta National Hospital in Nairobi, Kenya.<sup>18</sup> Githeko et al reported among diabetics attending peripheral health institutions a lower prevalence of 18.3% in central Kenya.<sup>19</sup>

Nkumbe et al reported 30.4% prevalence in newly diagnosed diabetes at Kenyatta National Hospital in 2002.<sup>20</sup> Mhando et al (1980) in Dar es Salaam reported a prevalence of 25 %.<sup>21</sup>

Kaimbo et al found a prevalence of 32% in the Democratic Republic of Congo.<sup>22</sup>

### **1.2.6 Risk factors**

Epidemiological surveys have shown that various risk factors known to be associated with diabetic retinopathy tend to accelerate its course and increase its severity.

These risk factors include:

#### **1.2.6.1 Duration of the disease**

Duration of diabetes mellitus is probably the strongest predictor for development and progression of retinopathy. The Wisconsin epidemiologic study of diabetic retinopathy (WESDR), the widest and most prolonged population-based ophthalmologic survey, reported that higher prevalence of diabetic retinopathy was associated with longer duration of diabetes.<sup>23</sup> In a study conducted by Dandona et al on type 2 diabetic patients, it was reported that 87.5% of those with diabetes for more than 15 years had diabetic retinopathy compared to 18.9% of those who had diabetes for less than 15 years.<sup>24</sup>

### **1.2.6.2 Glycaemic control**

There is strong evidence to suggest that the development and progression of diabetic retinopathy is influenced by the level of hyperglycaemia.<sup>25</sup>

The protective effect of glycaemic control on the development and progression of diabetic retinopathy has been investigated in both type 1 (WESDR and DCCT) and type 2 diabetic patients (UKPDS).<sup>26 27 28</sup>

In the 14 year progression of retinopathy study (WESDR), the prevalence of retinopathy in type 1 diabetic patients was 12% when glycated haemoglobin (HbA1c) was less than 7% as compared to 40.7% when HbA1c levels were greater than 10%. An increased risk of PDR was associated with more severe baseline retinopathy and higher HbA1c levels.<sup>23</sup>

In the UKPDS, the risk reduction in eye complications for every 1% decrease in HbA1c was 19%.<sup>28</sup> It is thus observed that long term glycaemic control plays an important role in delaying the onset and lowering down the progression of Diabetic retinopathy.

### **1.2.6.3 Hypertension**

Reports have indicated that high diastolic blood pressures in young individuals and higher systolic blood pressures in older individuals can worsen diabetic retinopathy.<sup>29</sup>

### **1.2.6.4 Renal disease**

A link between renal and retinal angiopathy in diabetes, has been long recognised. An effect that can be mediated through an increase in blood pressure, fibrinogen levels and

lipoproteins.<sup>30</sup> Cross sectional and longitudinal studies report a relationship between microalbuminuria, proteinuria and retinopathy.<sup>30 31 32</sup> Proteinuria was present in 29.2% of the subjects with diabetic retinopathy in the CURES eye study.<sup>17</sup>

#### **1.2.6.5 Pregnancy**

It is recognised that diabetic retinopathy can progress rapidly during pregnancy due to hormonal changes. The progression is usually transient and the long term risk progression of diabetic retinopathy does not appear to be increased by pregnancy.<sup>33</sup> A study carried out in Kenya showed no significant difference in pregnant and non pregnant women.<sup>34</sup>

#### **1.2.6.6 Other**

Other risk factors that have been shown to be associated with Diabetic retinopathy include: elevated serum lipid<sup>29 35</sup>, alcohol<sup>13 36 37</sup>, anaemia<sup>38 39</sup> and obesity.<sup>29</sup>

#### **1.2.6.7 Ocular Manifestations of Diabetes Mellitus**

Diabetes mellitus has numerous ocular manifestations. Many aspects of diabetic eye disease affect visual function and diabetic retinopathy is a common cause of blindness.<sup>40</sup>

##### **1.2.6.7.1 Ocular Complications Include:**<sup>41 42</sup>

Two types of cataract are associated with diabetes. Senile cataract which appears earlier and may progress more rapidly in a diabetic than a non-diabetic patient and true diabetic cataract which result from osmotic over hydration of lens.

The impaired circulation in the microvasculature of the diabetic eye may lead to ischemia of the optic disc. This leads to optic neuropathy. Ischemia can also affect cranial nerves innervating the extra ocular muscles, leading to any pattern of strabismus and diplopia. The 3<sup>rd</sup>, 4<sup>th</sup> and 6<sup>th</sup> cranial nerves are all susceptible to mononeuropathies from diabetes by the same mechanisms that lead to peripheral neuropathies.

Patients with diabetes are also at bigger risk of primary open angle glaucoma. In addition, ischemic factors may lead to neo-vascularisation of the anterior chamber angle, leading to neo-vascular glaucoma.

#### **1.2.6.7.2 Other Ocular manifestations can be classified into.**<sup>40 43</sup>

**Eyelids:** xanthelasmata due to hyperlipidaemia

**Conjunctival :** microaneurysms, venous dilatation

**Extra-ocular muscles:** palsy with diplopia caused by 3<sup>rd</sup>, 4<sup>th</sup> or 6<sup>th</sup> cranial nerve involvement

**Orbit:** Mucormycosis a potential complication of severe diabetic acidosis

**Iris:** Ectropion uvea, iris pigment at angle, neovascularisation of the anterior surface  
(rubeosis iridis)

**Pupil:** poor dilation caused by rubeosis iridis, Argyll Robertson pupil

**Cornea:** hypoesthesia (risk of neurotrophic keratitis) reduced tear production and thickened  
stroma

**Lenticular:** myopia during hyperglycaemia

**Ciliary body and choroid:** thickened basement membrane at the pigment epithelium of the pars plicata, arteriosclerosis of the choroid, obliterated lumen of the choriocapillaris at the macula.

### **Posterior Segment.**

**Vitreous :** vitreous haemorrhage, asteroid hyalosis and posterior vitreous detachment.

**Retina :** Retinal vein occlusion and lipaemia retinalis

: Diabetic retinopathy (DR) can be divided into 2 stages. It can occur with or without macular oedema.

### **Diabetic retinopathy stages**

#### **1. Nonproliferative retinopathy (NPDR)**

- Microaneurysms, dot and blot hemorrhages, hard exudates
- Preproliferative stage (cotton wool spot (CWS), venous beading, arteriolar narrowing and intraretinal microvascular abnormalities

#### **2. Proliferative retinopathy (PDR)**

- New vessels at the disc (NVD) or elsewhere (NVE)
- Vitreous hemorrhage, tractional retinal detachment and neovascular glaucoma

#### **3. Maculopathy**

- Exudative maculopathy
- Edematous maculopathy
- Ischemic maculopathy

**Optic nerve:** ischaemic papillitis, optic atrophy

## **Why is diabetic retinopathy a problem?**

Increasing prevalence of diabetes worldwide especially in developing countries, combined with worsening healthcare situation in sub-Saharan Africa is largely responsible for the current infectious nature of this non-communicable disease of which the low socioeconomic countries have not been spared from this epidemic. Majority of the general population lack knowledge about diabetes mellitus, the acute, short and long term complications. There are few trained personnel especially in the rural areas in Africa who are conversant with the management of diabetes. Githeko et al 2001 in Kenya reported among diabetics attending peripheral health institutions a prevalence of 18.3%.<sup>19</sup> Watkins et al in 2003 at Gondar, Ethiopia reported a prevalence of diabetes amongst a rural community in the north to be as low as 0.014%.<sup>63</sup> Drugs are not readily available at primary health care facilities. It is an expensive disease to manage because of the long term complications. Provision of knowledge to all afflicted and their families combined with screening will in the long term reduce cost to family members, friends and society at large.

### **1.4 Public Health intervention**

#### **1.4.1 Screening**

Diabetic retinopathy is the only blinding ocular disease in which severe visual loss can be avoided by photocoagulation.<sup>13</sup> Potentially blinding lesions of diabetic retinopathy such as proliferative NVD/NVE or clinically significant macular oedema (CSME) may develop a long time before the patient realizes visual deterioration. Since early diabetic eye disease is asymptomatic, screening is imperative. Screening for diabetic retinopathy requires an assessment

of best corrected visual acuity, a slit lamp examination and stereoscopic biomicroscopy of the fundus in mydriasis.<sup>6 13 44 45</sup>

Diabetic children should be screened for retinopathy after puberty. Patients with juvenile onset of diabetes should be screened once a year starting from year 8 after diagnosis has been made. Patients diagnosed with maturity onset of diabetes require fundus examination immediately because it is difficult to ascertain when they became diabetic.<sup>13</sup>

It has been shown that seven standard field stereoscopic 30° fundus photography is the gold standard for assessing diabetic retinopathy. However digital color photography can also be used.<sup>8,46</sup> Recently, several new non-invasive techniques promise to improve diagnostic sensitivity e.g the optical coherence tomography (OCT).<sup>47</sup>

#### **1.4.2 Health promotion**

Provision of knowledge is a very important tool in addressing the short and long term complications and adverse impacts on families, friends, economies and societies as a whole.

Organization of training and teaching in diabetes management and care should be done for all patients, their families, friends, working associates, and for the health care team.

#### **1.5 Research question**

This study was conducted to answer the research question: What is the magnitude, pattern and level of knowledge regarding diabetes and diabetic retinopathy among patients with diabetes mellitus at the Korle-Bu Teaching Hospital, Accra-Ghana?



## 2.0 RATIONALE

Data on diabetes and diabetic retinopathy in Ghana is scanty. Recent studies showed 6.3% crude prevalence of diabetes mellitus.<sup>4</sup> The magnitude of visual complications and blindness burden due to diabetic retinopathy in patients attending the Korle-Bu Teaching Hospital is not known, and this study sought to establish the nature and magnitude of diabetic retinopathy and level of awareness among diabetics. From anecdotal observations, it has been noted that patients diagnosed with diabetes mellitus presenting to the Korle-Bu Teaching Hospital Eye-Unit arrived with advanced retinopathy this is because patients are not fully aware of the diseased process and the ocular involvement.

### 3.0 STUDY OBJECTIVES

1. To determine the magnitude and pattern of diabetic retinopathy in diabetic patients attending the Korle-Bu Teaching Hospital.
  
2. To determine the association between diabetic retinopathy and the following known risk factors:
  - Duration of diabetes
  - Glycaemic control - fasting blood sugar (FBS), HbA1c
  - Blood pressure
  - Type of diabetes
  
3. To determine current levels of awareness regarding diabetes and retinopathy among the diabetic patients.

## **4.0 RESEARCH METHODS**

### **4.1 Study design**

This was a hospital based cross-sectional, analytical study.

### **4.2 Study area**

The study was conducted at Korle-Bu Teaching Hospital, Accra-Ghana.

### **4.3 Study population**

Study subjects considered were all diabetic patients attending Korle-Bu Teaching Hospital from the age of 12years and above and who met all the inclusion.

### **4.4 Study setting**

The Korle-Bu Teaching Hospital is Ghana's National Referral Hospital located in the capital city Accra, with a bed capacity of 2000(see Appendix IV). It is also the training center for Ghana's College of Health Sciences, comprising the University of Ghana Medical School, Post Graduate College, Dental and Nursing School, Schools of Nutrition, Radiography, Hygiene and Laboratory Technology. It has a diabetic centre that runs a diabetic clinic everyday, where an average 45-70 is seen daily.

### **4.5 Study period**

The study period from October to November 2009.

## 4.6 Sample size

The sample size was determined using the following formula

$$n = \frac{z_{1-\alpha/2}^2 P(1-P)}{D^2}$$

Where:  $n$  = is the required sample size

$P$  = estimated prevalence of diabetic retinopathy (estimated at 28% taking into consideration various hospital-based studies in Africa.)

$D$  = degree of precision or a tolerance error margin of the study set at 0.05

$Z_{1-\alpha/2}$  = is the critical value. For 95 % level of confidence, the critical value is 1.96

Using this information in the sample size formula above, we estimate that, the following sample size would be necessary to achieve the required sufficient precision for the study

$$n = \frac{z_{1-\alpha/2}^2 P(1-P)}{D^2}$$

Using  $D=5\%=0.05$

$$n = \frac{(1.96)^2 (0.28) (0.72)}{(0.05)^2}$$

$$= 309.786$$

$$\approx 300$$

#### **4.7 Inclusion criteria**

All diabetic patients aged 12 years and above who gave consent were enrolled.

#### **4.8 Exclusion criteria**

Patients with opaque ocular media, diabetic children less than 12 years and those who declined to give consent.

#### **4.9 Sampling method**

Convenience sampling technique was used where all diabetic patients attending Korle-Bu Teaching Hospital who meet all the inclusion and none of the exclusion criteria during the period of study were included. Convenience sampling is a non probability method.

Subjects were chosen in a non random manner. On each day the researcher saw between 5-20 patients.

#### **4.10 Procedure**

Patients, who came visiting the physician at the diabetic centre and other departments, were referred to the eye unit and recruited into the study. The researcher introduced herself on individual basis. Patients were explained the rationale of the study. An informed consent was obtained (Appendix III). Patients were interviewed using a structured questionnaire in English (appendix1), and translated to Ga, Ewe and Twi by the researcher if participants were not literate. Presenting visual acuity of subjects was assessed using Snellen's chart. Patients with visual acuity less than 6/9 a pinhole was used, those with visual acuity worse than 6/18 with clear ocular media were refracted by

the optometrist and this was counter checked by the principal investigator. The patient's blood pressure was measured in sitting position, after 5-10 minutes of rest using an automatic cuff blood pressure machine. HbA1c and FBS measured. Ocular adnexa, and anterior segment were assessed with Haag Streit slit lamp and only abnormal findings were recorded. Tear break-up time was assessed using moistened fluorescein strips to touch the palpebral conjunctiva and patient asked to close and open the eye, any break-up time below 10seconds was considered dry eye. Intraocular pressure was measured with Goldmann applanation tonometer after instilling 0.5% tetracaine hydrochloride immediately after tear break-up time (TBUT) assessment. The pupils were then dilated using tropicamide 1% eye drop every 5minutes for 15 to 20 minutes after instilling 0.5% tetracaine hydrochloride and posterior segment examined with indirect ophthalmoscope and 20D Loupe, after which stereoscopic binocular examination of the fundus was carried out using a slit lamp and a 90D loupe. Fundus findings was counter checked by a consultant ophthalmologist. Fundus photograph were taken of selected cases.

#### **4.11 Data Analysis**

Raw data was tallied into a well structured questionnaire (Appendix 1). This captured both socio-demographic and laboratory variables like: Age, Sex, Occupation, Education level, Cost of travel, Fasting Blood Sugar, Blood Pressure, HbA1c and Ocular examinations. Final Assessment of Diabetic Retinopathy was also obtained using a special table (Appendix II). The data sheets were filed and kept in a secure lockable cabinet. Data was then entered in Microsoft Excel (Ms 2007) password protected and analyzed using Statistical Package for Social Scientists (SPSS version 16.0 for Windows (SPSS

Inc.). Data was analyzed and presented in form of frequencies, proportions/percentages, graphs, charts (Pie charts), Histograms and association tables. Both Chi-square and Odds Ratio tests were then used to investigate association between diabetic retinopathy and known risk factor namely duration of diabetes, glycaemic control, blood pressure, type of diabetes. Both 95% confidence intervals (95 % CI) and  $p\text{-value} < 0.05$  was used to test the statistical significance of results.

#### **4.12 Ethical considerations**

Informed written consent was obtained from patients who were recruited into the study. Ethical clearance was obtained from the ethical committee, Korle-Bu Teaching Hospital. Participation in the study was purely voluntary. Instillation of mydriatics was explained to participants. Patient data was kept confidential; patients found to have disease were referred or treated whenever possible.

## 5.0 RESULTS

Three hundred and thirteen participants were recruited into the study

**Table 1: Socio-demographic data (n=313)**

| Characteristic           | Count       | Per cent |
|--------------------------|-------------|----------|
| <b>Age Distribution:</b> |             |          |
| Mean (sd)                | 55.3 (11.0) |          |
| Median                   | 55.0        |          |
| Range                    | 22 to 82    |          |
| IQR                      | 49 to 62    |          |
| < 30                     | 8           | 2.6      |
| 30-39                    | 7           | 2.2      |
| 40-49                    | 68          | 21.7     |
| 50-59                    | 119         | 38.0     |
| ≥ 60                     | 111         | 35.5     |
| <b>Sex:</b>              |             |          |
| Male                     | 109         | 34.8     |
| Female                   | 204         | 65.2     |
| <b>Occupation:</b>       |             |          |
| Unemployed               | 122         | 39.0     |
| Self-employed            | 111         | 35.0     |
| Formal-Employed          | 80          | 26.0     |
| <b>Education Level:</b>  |             |          |
| None                     | 25          | 8.0      |
| Primary                  | 58          | 18.5     |
| Secondary                | 165         | 52.7     |
| Tertiary                 | 65          | 20.8     |

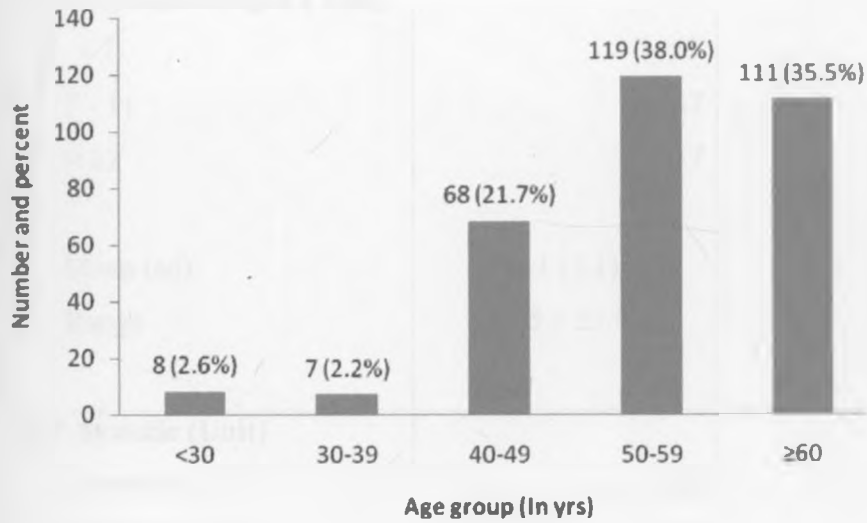
The mean age of the study was 55.3 years with a standard deviation of 11.0.

The median was 55years, and the interquartile range was 49-62 years.

M: F ratio was 1:2



**Figure 1: Distribution of participants by age, (n=313)**



The mean age was found to be 55.3years. Mode was 45yrs.

**Table 2: Glycaemic and Blood pressure status of the study population (n=313)**

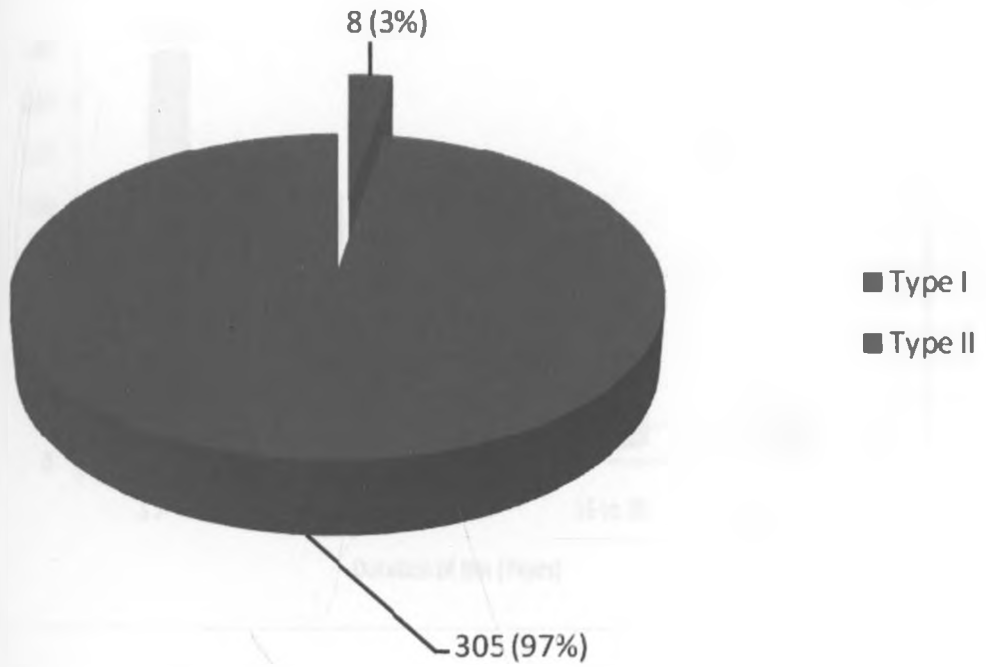
| <b>Finding</b>                     | <b>Count</b> | <b>Per cent</b> |
|------------------------------------|--------------|-----------------|
| <b>Fasting Blood Sugar ( unit)</b> |              |                 |
| < 7                                | 89           | 28.4            |
| 7 - 11                             | 167          | 53.4            |
| > 11                               | 57           | 18.2            |
| Mean (sd)                          | 9.1 (3.1)    |                 |
| Range                              | 3.5 – 23.5   |                 |
| <b>B/P-Systolic (Unit)</b>         |              |                 |
| Normal < 140                       | 205          | 65.5            |
| Abnormal $\geq$ 140                | 108          | 34.5            |
| Mean (sd)                          | 131.5 (14.5) |                 |
| Range                              | 96 - 205     |                 |
| <b>B/P-Diastolic (Unit)</b>        |              |                 |
| Normal <90                         | 97           | 31.0            |
| Abnormal $\geq$ 90                 | 216          | 69.0            |
| Mean (sd)                          | 79.4 (9.6)   |                 |
| Range                              | 44 - 119     |                 |

Only 89 participants (28.4%) had fasting blood sugars less than 7.0 mmol/L.

The mean systolic and diastolic pressures were 131.5 and 79.4mmHg respectively.

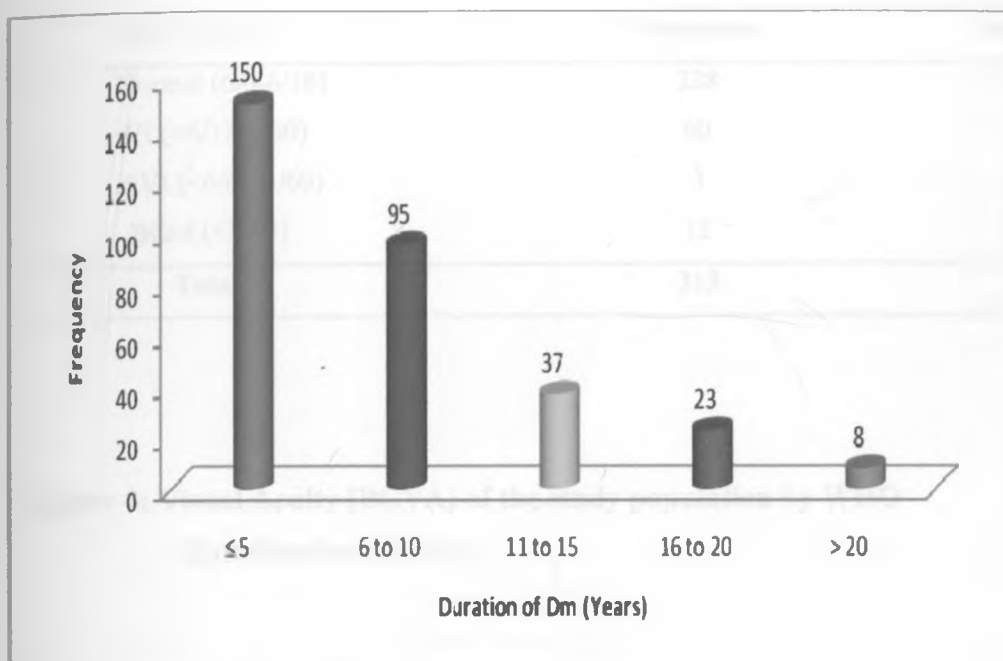
The ranges were 96-205(systolic) and 44-119(diastolic).

**Figure 2: Type of diabetes of the study population (n=313)**



Majority of participants had type II Diabetes 305 (97.0%).

**Figure 3: Duration of Diabetes in years (n = 313)**

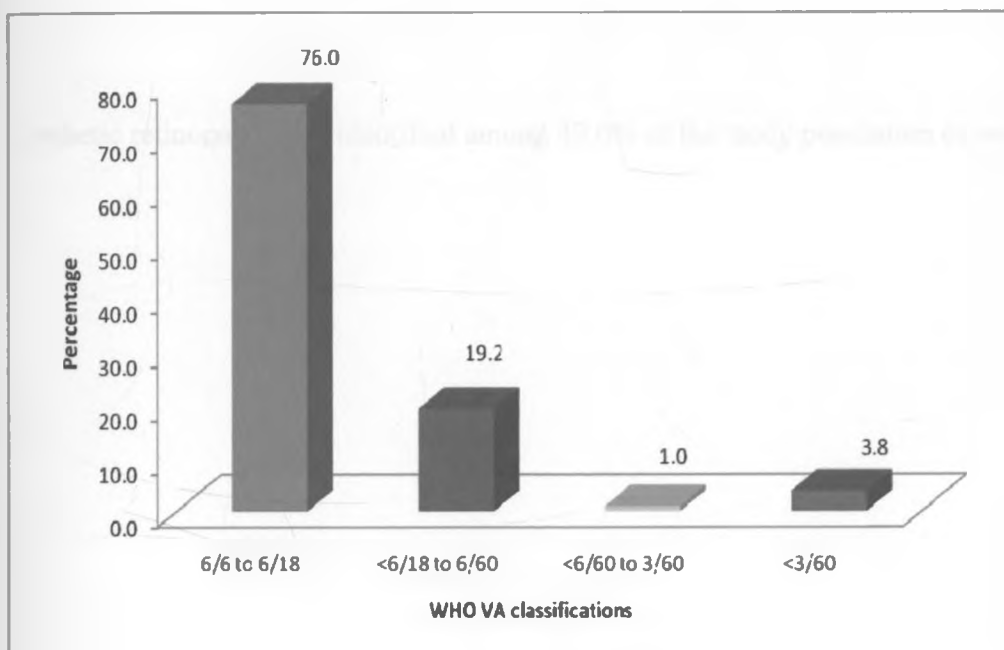


The mean duration of diabetes was found to be 7.2years with a standard deviation of 5.5. The median was 6.0years and the mode 3.0years. Minimum was 10 years and maximum 25years.

**Table 3: Visual Acuity (BCVA) of the study population by WHO Classification (n=313)**

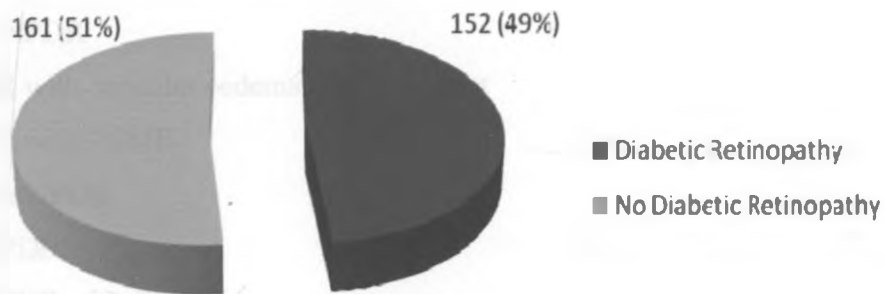
| Visual acuity     | Frequency  | Percent    |
|-------------------|------------|------------|
| Normal (6/6-6/18) | 238        | 76.0       |
| VI (<6/18-6/60)   | 60         | 19.2       |
| SVI (<6/60-3/60)  | 3          | 1.0        |
| Blind (<3/60)     | 12         | 3.8        |
| <b>Total</b>      | <b>313</b> | <b>100</b> |

**Figure 4: Visual Acuity (BCVA) of the study population by WHO Classification (n=313)**



Most of the patients 76.0% had normal vision while 3.8% were blind by WHO classification.

**Figure 5: Prevalence of Diabetic Retinopathy (n=313)**



Diabetic retinopathy was identified among 49.0% of the study population examined.

**Table 4: Classification of diabetic retinopathy in the worst eye using the Early Treatment diabetic retinopathy study (n=313)**

| <b>Final Assessment of DR</b>            | <b>Frequency</b> | <b>Percent</b> |
|--|------------------|----------------|
| Normal                                   | 161              | 51.4           |
| Mild NPDR                                | 38               | 12.1           |
| NPDR with macular oedema not significant | 13               | 4.2            |
| NPDR with CSME                           | 44               | 14.1           |
| Severe NPDR                              | 3                | 1.0            |
| NHRPDR                                   | 22               | 7.0            |
| NHRPDR with CSME                         | 9                | 2.9            |
| HRPDR                                    | 12               | 3.8            |
| HRPDR not amenable to photocoagulation   | 11               | 3.5            |
| <b>Total</b>                             | <b>313</b>       | <b>100</b>     |

NPDR with CSME was found in 44 (14.1%), Severe NPDR was found in 3(1.0%) and HRPDR not amenable to photocoagulation 11(3.5%)

**PART II: ASSOCIATIONS OF RISK FACTORS VERSUS DIABETIC RETINOPATHY**

**Table 5: Association between visual acuity and diabetic retinopathy (n=626)**

| Visual acuity | DR         | NO DR   | OR(95% CI)       | P-value |
|---------------|------------|---------|------------------|---------|
| <6/18         | 145(47.7)  | 74 (23) | 3.1 (2.2 to 4.3) | <0.001  |
| ≥6/18         | 159 (52.3) | 248(77) |                  |         |

Patients with visual acuity <6/18 are 3.1 more likely to develop diabetic retinopathy than those persons with visual acuity ≥ 6/18.

**Table 6: Association between diabetic retinopathy and best corrected visual Acuity of participants (n=626)**

| Visual Acuity     | Diabetic Retinopathy Status |             | P- value |
|-------------------|-----------------------------|-------------|----------|
|                   | DR                          | No DR       |          |
| Normal (6/6-6/18) | 159(52.3%)                  | 248(77.0 %) | <0.001   |
| VI (<6/18-6/60)   | 87(28.6%)                   | 57(17.5%)   |          |
| SVI (<6/60-3/60)  | 22(7.2%)                    | 5(1.6%)     |          |
| Blind (<3/60)     | 36(11.8%)                   | 12(3.7%)    |          |

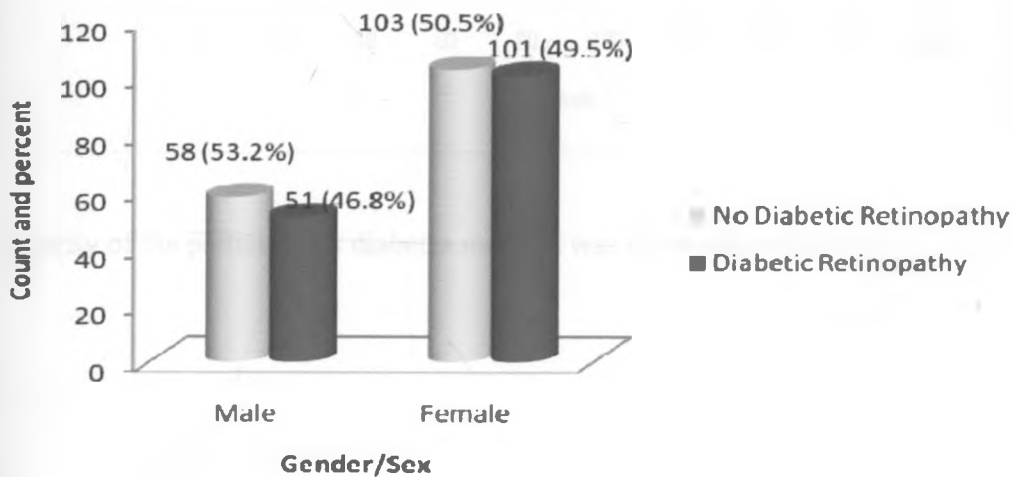
Visual acuity was significantly associated with diabetic retinopathy. Patient with visual impairment and severe visual impairment were more likely to have diabetic retinopathy.



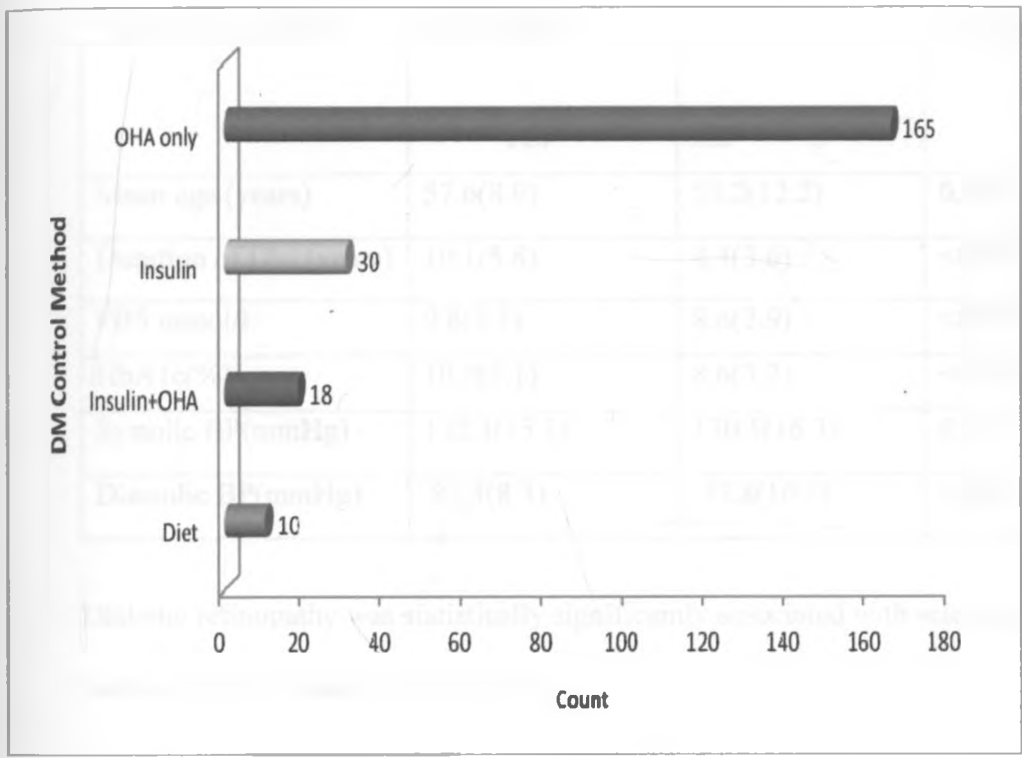
**Table 7: Distribution of diabetic retinopathy (DR) and sex of participants**

| DR                   | Sex       |            | P-value |
|----------------------|-----------|------------|---------|
|                      | Male      | Female     |         |
| Diabetic Retinopathy | 51 (46.8) | 101 (49.5) | 0.646   |
| Normal               | 58 (53.2) | 103 (50.5) |         |

Diabetic retinopathy was not associated with the sex of the participants



**Figure 6: Modality of treatment the participants were receiving**



Majority of the participant's diabetes mellitus was controlled with OHA.

**Table 8: Association of diabetic retinopathy with selected risk factors****(Univariate Analysis)**

| Variable mean(SD)      | DR Status   |             | P-value |
|------------------------|-------------|-------------|---------|
|                        | Yes         | No          |         |
| Mean age (years)       | 57.6(8.9)   | 53.2(12.2)  | 0.001   |
| Duration of DM (years) | 10.1(5.8)   | 4.4(3.6)    | <0.001  |
| FBS mmol/L             | 9.8(3.1)    | 8.6(2.9)    | <0.001  |
| HbA1c(%)               | 10.0(3.1)   | 8.6(3.2)    | <0.001  |
| Systolic BP(mmHg)      | 132.3(15.1) | 130.5(16.3) | 0.134   |
| Diastolic BP(mmHg)     | 81.3(8.3)   | 77.8(10.3)  | 0.002   |

Diabetic retinopathy was statistically significantly associated with selected risk factors except systolic blood pressure.

**Table 9: Multivariate Analysis**

| Variate                                       | Estimate | SE   | Wald  | P-value      | ODD | 95% CI |       |
|---|----------|------|-------|--------------|-----|--------|-------|
|   |          |      |       |              |     | Lower  | Upper |
| <b>Intercept</b>                              | -4.39    | 1.61 | 7.46  | <b>0.006</b> |     |        |       |
| <b>Age in years</b>                           | 0.00     | 0.02 | 0.02  | 0.902        | 2.7 | 2.6    | 2.8   |
| <b>Duration of DM</b>                         | 0.24     | 0.04 | 47.61 | <b>0.000</b> | 3.6 | 3.3    | 3.9   |
| <b>FBS</b>                                    | -0.44    | 0.22 | 4.14  | <b>0.042</b> | 1.9 | 1.5    | 2.7   |
| <b>HbA1c</b>                                  | 0.56     | 0.21 | 7.35  | <b>0.007</b> | 5.8 | 3.2    | 13.9  |
| <b>Systolic BP</b>                            | 0.00     | 0.01 | 0.01  | 0.910        | 2.7 | 2.7    | 2.8   |
| <b>Diastolic BP</b>                           | 0.02     | 0.02 | 1.65  | 0.199        | 2.8 | 2.7    | 2.9   |
| <b>Visual Acuity<br/>≥ (6/18); &lt;(6/18)</b> | -0.37    | 0.37 | 1.03  | 0.311        | 2.0 | 1.4    | 4.1   |
| <b>Reference</b>                              |          |      |       |              |     |        |       |

Duration of DM, FBS and HbA1c were the only independent determinants for diabetic retinopathy.

**Table 10: Fasting blood sugar levels and grading of diabetic retinopathy**

| <b>Final Assessment of DR</b>            | <b>Frequency</b> | <b>Mean FBS</b> |
|--|------------------|-----------------|
| Normal                                   | 161              | 8.6             |
| Mild NPDR                                | 38               | 9.4             |
| NPDR with macular oedema not significant | 13               | 10.3            |
| NPDR with CSME                           | 44               | 10.0            |
| Severe NPDR                              | 3                | 12.8            |
| NHRPDR                                   | 22               | 10.2            |
| NHRPDR with CSME                         | 9                | 9.4             |
| HRPDR                                    | 12               | 11.1            |
| HRPDR not amenable to photocoagulation   | 11               | 12.5            |

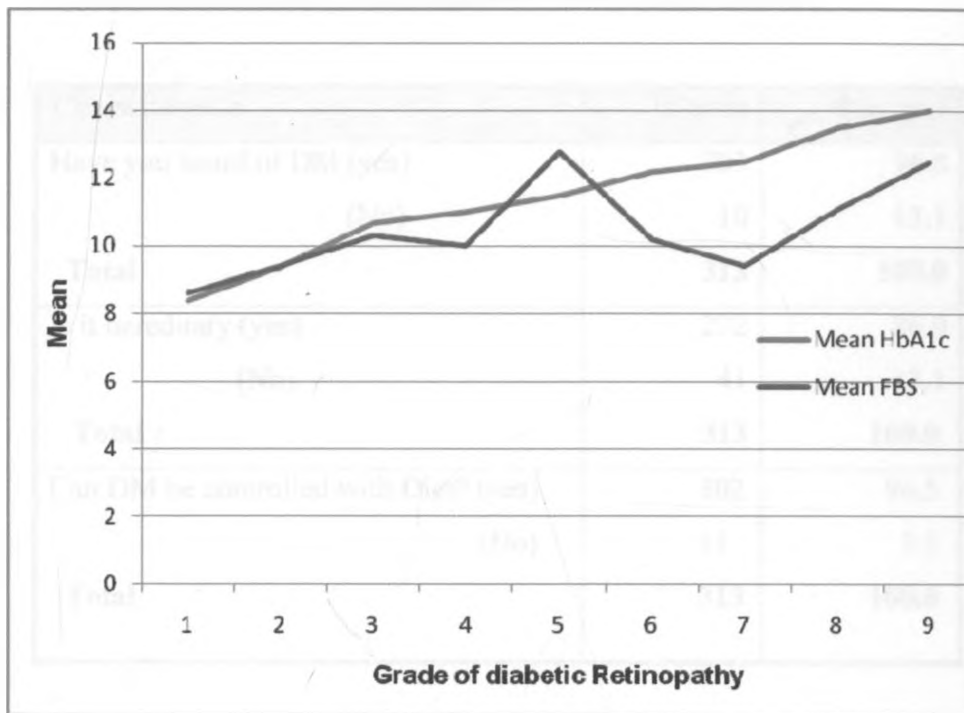
There was a general increase in level of FBS and severity of retinopathy

**Table 11: HbA1c levels and grading of diabetic retinopathy**

| <b>Final Assessment of DR</b>            | <b>Frequency</b> | <b>Mean HbA1c</b> |
|--|------------------|-------------------|
| Normal                                   | 161              | 8.4               |
| Mild NPDR                                | 38               | 9.4               |
| NPDR with macular oedema not significant | 13               | 10.7              |
| NPDR with CSME                           | 44               | 10.0              |
| Severe NPDR                              | 3                | 11.50             |
| NHRPDR                                   | 22               | 12.20             |
| NHRPDR with CSME                         | 9                | 12.50             |
| HRPDR                                    | 12               | 13.50             |
| HRPDR not amenable to photocoagulation   | 11               | 14.0              |

HbA1c level increased with severity of diabetic retinopathy

**Figure 7: Comparing mean HbA1c, mean FBS levels and severity of diabetic retinopathy**



HbA1c increased steadily with severity of diabetic retinopathy compared with FBS

**PART II: LEVEL OF AWARENESS REGARDING DIABETES AND  
RETINOPATHY**

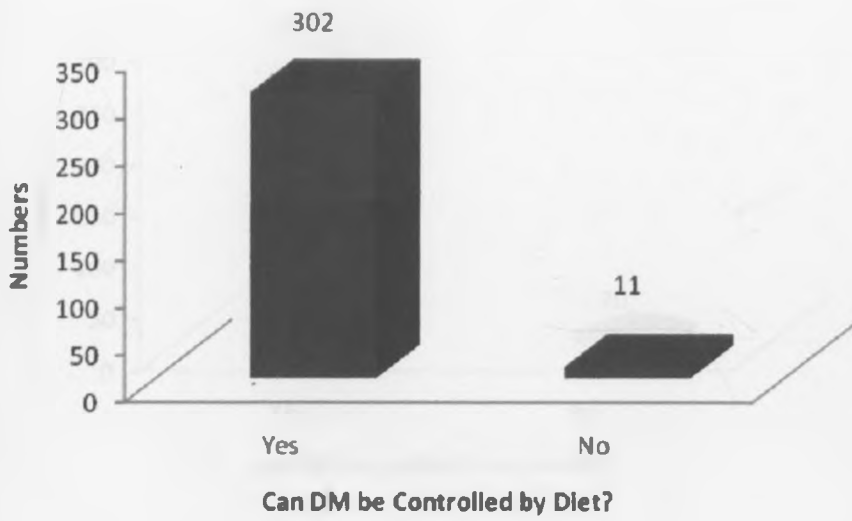
**Table 12: Knowledge of DM/Diabetic retinopathy (n=313)**

| <b>Characteristic</b>                 | <b>Count</b> | <b>Per cent</b> |
|---------------------------------------|--------------|-----------------|
| Have you heard of DM (yes)            | 303          | 96.8            |
| (No)                                  | 10           | 13.1            |
| <b>Total</b>                          | <b>313</b>   | <b>100.0</b>    |
| Is it hereditary (yes)                | 272          | 86.9            |
| (No)                                  | 41           | 13.1            |
| <b>Total</b>                          | <b>313</b>   | <b>100.0</b>    |
| Can DM be controlled with Diet? (yes) | 302          | 96.5            |
| (No)                                  | 11           | 3.5             |
| <b>Total</b>                          | <b>313</b>   | <b>100.0</b>    |

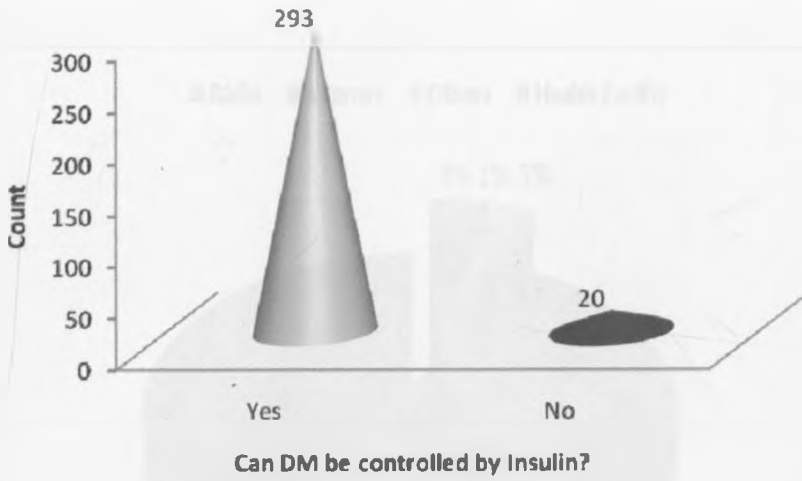
Nearly all participants (96.8%) had knowledge on diabetes Mellitus.

Majority (86.9%) believed that diabetes mellitus is hereditary.

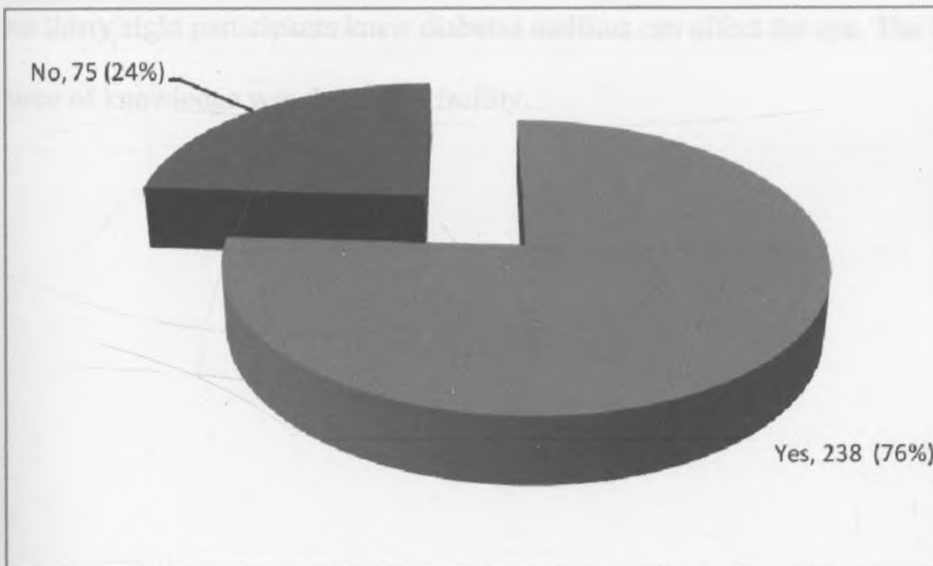
Knowledge regarding control of DM was high among participants.



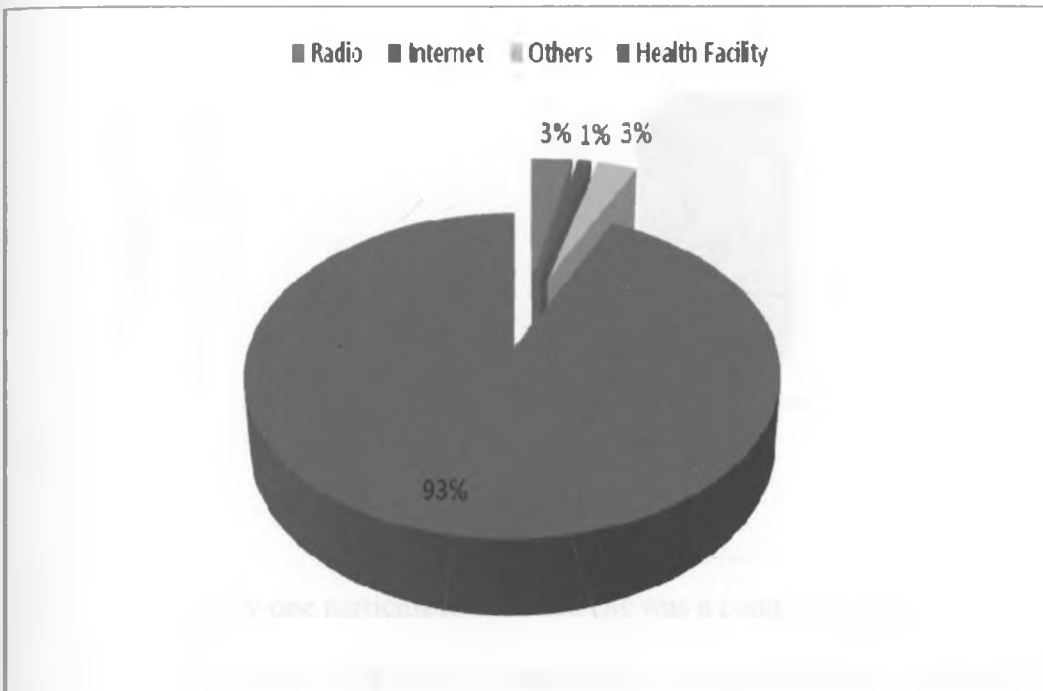




**Figure 8: Knowledge on effects of DM on eyes (n = 313)**

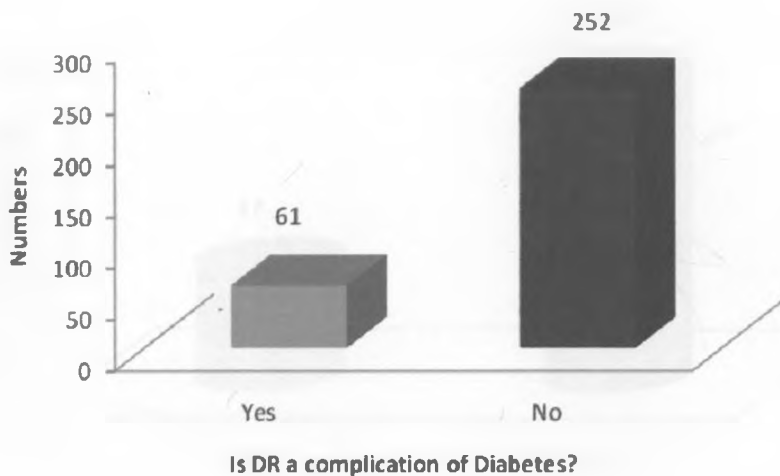


**Figure 9: Sources of Knowledge on effects of DM on eyes (n=238)**



Two thirty eight participants knew diabetes mellitus can affect the eye. The highest source of knowledge was the health facility.

**Figure 10: Specific knowledge on diabetic retinopathy (n=313)**



Sixty-one participants reported DR was a complication of DM.

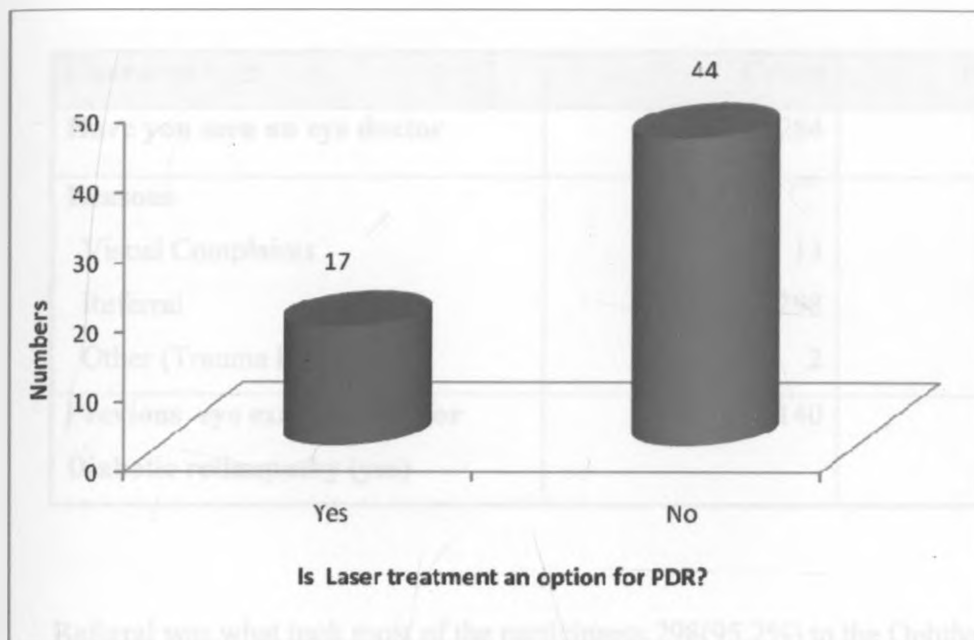
Knowledge that diabetic retinopathy is a complication of diabetes was low among participants 61(19.5%).

**Sources of Knowledge on diabetic retinopathy (n=61)**

| Characteristic   | Count | Per cent |
|------------------|-------|----------|
| Healthy Facility | 54    | 89       |
| Radio            | 9     | 15       |
| Internet         | 4     | 7        |
| Others           | 6     | 10       |
| TOTAL            | 73    | 121      |

Participants reported multiple sources of knowledge on Diabetic retinopathy.

**Figure 11: Specific knowledge on Proliferative diabetic retinopathy (n=61)**



Seventeen participants knew laser is an option for PDR treatment.

**Sources of Knowledge on laser treatment of PDR (n=17)**

| Characteristic   | Count | Per cent |
|------------------|-------|----------|
| Healthy Facility | 10    | 59.0     |
| Radio            | 6     | 35.3     |
| Internet         | 4     | 23.5     |
| Others           | 5     | 29.4     |
| TOTAL            | 25    | 147      |

Participants reported multiple sources of knowledge on PDR.

**Table 13: Reasons for visiting the eye doctor/previous DR assessment (n=313)**

| <b>Characteristic</b>  | <b>Count</b> | <b>Per cent</b> |
|--|--------------|-----------------|
| <b>Have you seen an eye doctor</b>                             | 284          | 90.7            |
| <b>Reasons</b>   |              |                 |
| Visual Complaints  | 13           | 4.2             |
| Referral   | 298          | 95.2            |
| Other (Trauma LE)  | 2            | 0.6             |
| <b>Previous eye examination for Diabetic retinopathy (yes)</b> | 140          | 44.7            |

Referral was what took most of the participants 298(95.2%) to the Ophthalmologist. However 13(4.2%) had visual complains and 140 (44.7%) had previous eye examination.

**Table 14: Distance, cost of travel, escort and physician visits per year (n=313)**

| <b>Characteristic</b>                     | <b>Count</b> | <b>Per cent</b> |
|---|--------------|-----------------|
| <b>How far do you stay</b>                |              |                 |
| Within town                               | 294          | 93.9            |
| Outside                                   | 19           | 6.1             |
| <b>Cost of Travel (USD)</b>               |              |                 |
| Mean                                      | 4.9 (4.1)    |                 |
| Range                                     | 0.25-40.0    |                 |
| <b>Did you come with an escort? (yes)</b> | 84           | 26.0            |
| <b>Visits per year to the physician.</b>  |              |                 |
| Don't know                                | 15           | 4.8             |
| 1   | 2            | 0.6             |
| 2   | 30           | 9.6             |
| 3   | 131          | 42.0            |
| 4   | 106          | 34.0            |
| 6   | 6            | 2.0             |
| 12  | 23           | 7.3             |

Majority of the participants were residents of Accra 294(93.9 %) compared with 19(6.1 %) non-residents. Escorted participants were 84(26.0%). The highest number of visit to the physician per year was 3(131) 42.0%.

**Table 15: Cost Coming to Hospital (USD)**

| <b>Cost of Coming to Hospital</b> |              |                    |                     |
|-----------------------------------|--------------|--------------------|---------------------|
| <b>Statistics</b>                 | <b>Total</b> | <b>Within Town</b> | <b>Outside Town</b> |
| Mean                              | 4.3          | 4                  | 8.5                 |
| Median                            | 3            | 3                  | 8.5                 |
| IQR                               | 2 to 5       | 2 to 5             | 2 to 12             |

The mean cost of travel to the hospital was 4USD for participants within town, 8.5USD for those outside.

## 6.0 DISCUSSION

Male to female ratio was noted to be 1:2 (shown in table 1) this is in keeping with Wild et al's findings that more women are living with diabetes mellitus than men in spite of the high male prevalence and that the most important demographic change across the world was diabetics in age group above 65years.<sup>3</sup> Secondly, this is also consistent with the 2010 Population and Housing Census conducted in Ghana where females were found to outnumber males in 8 regions except 2. Greater-Accra, the capital City of Ghana where this study was conducted has one of highest number of female inhabitants after Ashanti-region which is the second largest city.<sup>55</sup>

Kaimbo et al, 1995 in Service d'Ophthalmologie, Cliniques Universitaires de Kinshasa reported the reverse male to female ratio was 2:1.<sup>22</sup> In this study, gender was not a significant predisposing factor to development of diabetic retinopathy (Table7).<sup>18 22 48 50 51</sup> Khandekar et al 2003, in a hospital based study, conducted in Oman, found a different pattern men had significantly higher rate of retinopathy than women. The retinopathy rate was higher in age groups 50-59 years and 60-69 years.<sup>52</sup> Chijioke et al 2010 at University Teaching Hospital, Ilorin, Nigeria observed high male preponderance.<sup>60</sup> Ahrén et al 1985 also reported male predilection in a rural setting among diabetics in northern Tanzania.<sup>61</sup>

Unemployment rate was 122(39.0%) and the reason assigned by participants was persistent ill health attributable to diabetes mellitus and this impacted negatively on affordability of health care services, also they were unable to pay the needed premium in order to access the National Health Insurance Scheme which caters for persons with acute and chronic ailments like diabetes. The other category was the self-employed 111(35%), consisting of farmers and persons engaged in business who worked in their own small private capacities with no constant income generation hence making it difficult or virtually impossible to visit the physician as demanded by



their medical conditions affecting them. Formal-Employed 80 (26.0%) were in the minority, this pattern of unemployment is similar to the National employment policy-first draft Version document prepared by Ministry of Manpower, Youth and Employment.<sup>56</sup> The general unemployment situation in Ghana is high so that diabetics and other chronically ill patients who are gainfully employed, but however happens to miss work because of the disease are more likely to lose their jobs and not by virtue of their condition.

Of the 313 participants, 165(52.7%) had attained secondary and tertiary education level respectively 65(20.8%). Literate participants from my observation appeared more informed. Education is also a determining factor in access to health care services. Lack of education can make navigating access to health care difficult and may prevent awareness of the benefits of health promotion, disease prevention and early treatment in order to prevent acute complications and to reduce the risk of long-term complications.

Predominately Type II Diabetes was found 305(97.0%), with the assumption that diagnosis was made before 40yrs of age and type 1 8(3%). The ratio was 1:40 (Figure 2) and this can be explained by the fact that majority of the participants were middle aged, with the peak age between 50 to 59years as illustrated in (figure 1). Levitt et al in Cape Town-South Africa, in 2008 reported Type II diabetes constituted 90% of diabetic population in Sub-Saharan Africa.<sup>57</sup> Mbanya et al 2010 in Yaoundé,Cameroon reported an increased prevalence and burden of type II diabetes in Sub-Saharan Africa.<sup>58</sup> Ramachandran et al 2007 observed, type II diabetes to be the commonest form of diabetes constituting 90% of the diabetic population in any country.<sup>59</sup> Chijioko et al 2010 in Ilorin, Nigeria reported Type II DM, to be the commonest of two basic types of DM due to environmental and genetic risk factors.<sup>60</sup>

Of, the 313 diabetics examined 49.0% were found to have characteristics of diabetic retinopathy Kariuki et al 1999 reported a slightly higher prevalence of 49.8% at Kenyatta National Hospital in Nairobi, a referral centre and also the Teaching Hospital for the University of Nairobi, this setting is comparable to Korle-Bu Teaching Hospital situated in Accra-Ghana.<sup>18</sup> Guadie et al 2009 reported a comparable prevalence of 41.4% at Jimma University Teaching Hospital in Ethiopia.<sup>51</sup> Similar study conducted in Addis Ababa by Seyoum et al showed a much lower prevalence of 37.8 %.<sup>48</sup> Kaimbo et al found a prevalence of 32% in Democratic Republic of Congo.<sup>22</sup> Mutangana et al 2008 found a prevalence of 29.2% in Kigali, Rwanda in 3 different hospitals.<sup>50</sup> Nkumbe et al reported 30.4% prevalence in newly diagnosed diabetes at Kenyatta National Hospital in 2002.<sup>20</sup> Khandekar et al 2003, in a hospital based study, conducted in Oman reported a lower prevalence 14.39%.<sup>52</sup> Githeko et al 2001 in Kenya reported among diabetics attending peripheral health institutions a much lower prevalence of 18.3%.<sup>19</sup> Watkins et al in 2003 at Gondar, Ethiopia reported a prevalence of diabetes amongst a rural community in the north to be as low as 0.014%.<sup>63</sup>

The high prevalence of diabetic retinopathy in this study is because majority of the patients were referrals 298(95.2%) shown in table 13. Secondly obesity, physical inactivity and urbanization partly explains the increased levels of type 2 diabetes among the study population of whom majority were diagnosed with retinopathy at presentation.<sup>29 57</sup> Thirdly poor glycaemic control both FBS, HbA1c and elevated blood pressure has been reported to worsen the progression of diabetic retinopathy shown in table 2 and most of the participants had elevated values of these risk factors.<sup>23 25 26 27 28 29</sup>

Pattern of diabetic retinopathy in the worse eye, using the Early Treatment Diabetic Retinopathy study classification (Appendix II) as illustrated in table 4. One hundred and sixty one (51.4%)

patients did not have diabetic retinopathy. Categorizing these patients into 2 broad groups namely preproliferative 98(31.4%) and proliferative diabetic retinopathy 54(17.2%). Guadie et al 2009, in a recent study at Jimma Teaching Hospital Ethiopia, reported 126(38.9%) and 8(2.4%)<sup>51</sup> compared with Seyoum et al 2001 in Addis Ababa in a much older study 108 patients (36.1%) had background retinopathy and 5 patients (1.7%) had proliferative retinopathy.<sup>48</sup> The rates of background retinopathy, proliferative retinopathy, and diabetic maculopathy were 8.65%, 2.66%, and 5.12%, respectively in Oman 2003 by Khandekar et al.<sup>52</sup> Koki et al 2010 in Cameroun found out 128 subjects (64.7%) had non-proliferative DR (NPDR) in both eyes; 53(26.8%) proliferative DR(PDR) in both eyes and 14 (7.1%) were discordant, with NPDR in one eye and PDR in the other. Macula edema was found in 21 angiographies (10.6%). In all, 6.9% of the subjects were blind.<sup>60</sup>

In this study, the worse eye was considered, 98 (31.4%) compared to other studies that looked at both eyes, In the preproliferative group 44(14.1%) had CSME which is much higher than what was reported in Yaoundé, Cameroon 2010 by Koki et al, an angiographic study of diabetic subjects.<sup>67</sup> All these patients were referred for laser therapy in view of the CSME. A total of 54 (17.2%) had proliferative diabetic retinopathy out of which 12(3.8%) were HRPDR and 11(3.8%) were not amenable to photocoagulation as illustrated by 10.0 selected fundus photographs. One of the participants had single eye which had Macula hole with fibro vascular proliferation. Visual acuity, using the WHO classification, was significantly associated with diabetic retinopathy shown in table 5, so that patients with visual acuity <6/18 were 3.1 times more likely to develop diabetic retinopathy. Patients with visual acuity <3/60 in the better eye 36 (11.8 %) were considered blind shown in table 6. Majority of the participants 307 (98.0%) knew diabetes mellitus was controlled with OHA, diet 302 (96.50%) then Insulin 293 (93.6%)

illustrated in table 12, however 57 (18.2%) still presented with advanced retinopathy table 4. Two hundred and twenty three could recollect the modality of treatment they were receiving figure 6 where OHA was the commonest drug. The reason behind these findings were the higher mean age, 57.6 years, long duration of DM 10.1years, poorly controlled glycaemic levels (FBS=9.8mmol/L; HbA1c=10.0%) and blood pressure these were found to be statistically significant on univariate analysis except for systolic blood pressure table 8 compared with those without retinopathy. This finding is in keeping with other studies, Khandekar et al 2003, in Oman made a similar observation where the retinopathy rate was higher in age groups 50-59 years and 60-69 years.<sup>52</sup> Chijioke et al 2010 in Ilorin, Nigeria reported total mean age amongst diabetic subjects at diagnosis  $53.43 \pm 15.07$ .<sup>60</sup> McLarty et al 1989 reported mean age of  $54 \pm 20$  for diabetic subjects in a rural setting in Tanzania and 37 (17) years for the whole population.<sup>62</sup> Koki et al, in Yaoundé, Cameroon, 2010 found a higher mean age 58.6 years with longer mean duration of diabetes of 12.8 years.<sup>67</sup> This study found 55.3years and 7.2 years respectively among the participants.

On multivariate analysis, model, Fits Statistics was employed. The model is adequate with p-value of  $<0.001$ , the significant risk factors from the above analysis in table 9 were duration of DM: OR=3.6 (95 % CI 3.3-3.9), FBS OR=1.9 (95% CI 1.5-2.7) and HbA1c OR=5.8 (95% CI 3.2-13.9) were the only independent determinants for diabetic retinopathy. Systolic blood pressure was not statistically significant on univariate analysis in table 8  $p=0.134$ , however diastolic blood pressure was  $p = 0.002$ . On multivariate analysis using the Fits model there was colineality hence the effect of one nullify the other, both had confidence interval (95% CI 2.7-2.8) and (95% CI 2.7-2.9) respectively which is greater than 1.

In this study 108 (34.45%) had abnormal systolic blood pressure with a mean (sd) 131.5 (14.5), the range was 96-205mmHg. Hypertension was classified as systolic blood  $\geq 140$ mmHg and diastolic  $\geq 90$ mmHg. Diastolic blood pressure was found in 216 (69.9%) with a mean (sd) 79.4 (9.6) and the range was 44-119 (table 2). In this study, diastolic blood pressure was high in 69.9% compared with the systolic of 34.5% and this has a negative impact on younger and older individuals. In table 8 diastolic blood pressure was found to be statistically significant  $p=0.002$ . Van Leiden et al, in Amsterdam, the Hoorn study reported elevated levels of blood pressure, lipids and obesity are associated with retinopathy.<sup>29</sup>

Levels of awareness regarding diabetes and retinopathy, regarding diabetes 303(96.8%) had heard of the diabetes mellitus, modality of control, while 272(86.9%) new the mode of inheritance (table 12). The participants 238 (76%) generally knew diabetes can affect the eye (figure 8) self reported effects cataract, dry eye and blindness due to diabetic retinopathy. The source of this knowledge was largely the health facility 222(93%), internet (1%), radio (3%) and others (3%) e.g leaflets, posters, books, media and talk show (shown in figure 9). Specific knowledge on diabetic retinopathy was assessed, showed 61(19.5%) and sources of knowledge was multiple (figure 10), however when it came to management of PDR only 17 participants new about laser therapy (Figure 11). None of the participants diagnosed with HPDR not amenable to photocoagulation had knowledge on laser therapy. Dandona et al reported a high level (28.8%) of awareness about diabetic retinopathy among an urban general population in India; and increased awareness of diabetic retinopathy was found in individuals belonging to upper and middle socio-economic strata.<sup>9</sup> Rani et al observed a higher level of knowledge of diabetes among women compared with men. Knowledge of diabetic retinopathy was significantly higher

among subjects belonging to upper socio-economic compared with the extreme lower socio-economic strata in India.<sup>10</sup>

Kay et al in Minnesota-America 1999 reported physicians, nurses, and dietitians were the primary sources of information overall, however they were not the only sources, (80%) used at least four different educational resources.<sup>69</sup> The influence of education on clinical outcomes for people with diabetes is well documented in the literature.<sup>45 70-75</sup> Hospital admissions for people whose diabetes is not controlled are often due to patients' lack of information about diabetes.<sup>63</sup> Results of the Diabetes Control and Complications Trial suggest that increasing patients' knowledge is one key for achieving and maintaining near normal glycaemic levels.<sup>68</sup> Rwiza et al 1986 in Muhimbili Medical centre in Tanzania reported diabetes mellitus to be a rare or nonexistent disease because of lack of awareness leading to little detection.<sup>72 73</sup>

Assessment of participant's knowledge on diabetic retinopathy and proliferative retinopathy posed a challenge in view of the highly specialized nature of the subject area to be investigated my input at this stage was in depth. Participants were asked if they knew that diabetes can damage the retina which is the back of the inside of the eye and the condition was termed DR. The small blood vessels in the retina became weak, leaked blood or other fluid in the eye, an over accumulation of glucose damaged the tiny blood vessels in the retina. There are two stages of diabetic retinopathy namely nonproliferative and proliferative (PDR), either of these could be associated with swelling of the macula or without, the part of the retina that lets us see detail this condition is referred to as macula oedema. Macula oedema occurs when damaged blood vessels leak fluid and lipids onto the macula. Nonproliferative diabetic retinopathy if untreated progressed to PDR stage. PDR stage is characterized by growth of blood vessels. The lack of

oxygen for the retina caused fragile, new blood vessels to grow along the retina as well as a clear gel-like vitreous humour that filled the inside of the eye. This could bleed and cloud vision, without timely intervention. The new blood vessels being defective; bled and caused scar tissue to form. The scar tissue might pull the retina off its base, a condition called retinal detachment.

Fibro vascular proliferation could cause tractional retinal detachment as well. The blood vessels could grow into the angle of the anterior chamber of the eye known as neovascular glaucoma. The management of PDR was directing red spot of light to the back of the inside of the eye, sparing the macula referred to as laser therapy amongst others.

In this study majority of the patients had seen an eye doctor 284 (90.7%), but only a 1/3 had had an eye exam 140 (44.7%) dilated funduscopy, but still lacked knowledge about diabetic eye disease. In fact what most of them described as ophthalmologist was dispensing optician and optometrist services, and they were generally managed for refractive errors including presbyopia, dry eye syndrome. Cost of travel to the hospital was worth investigating especially in Sub-Saharan Africa where people live on less than one dollar per day.<sup>57</sup> Diabetes being a chronic disease it required permanent source of finance to ensure adequate compliance. Cost was 4.3 USD for residents within town and 8.5 USD outside town (table 15). Eighty four participants were escorted to the clinic among these were youngsters of school going age and also middle aged persons who had to lose income that day in order to accompany their loves for treatment.<sup>49</sup> Since the disease requires a multidisciplinary approach, physician visits was investigated in order to ascertain regular check-up which will eventually lead to picking up complications on time. Diabetes and diabetic retinopathy is a major public health concern worldwide, in spite of this; the

current management is based primarily on the experience, research results and technological advancement from the developed world.

The profound visual implications if not well controlled cannot be over emphasized and could be distressing for the patient, families and society at large.

In Ghana, this was the first hospital based study conducted to ascertain the burden and pattern of diabetic retinopathy. Convenience sampling method was used due to time constraint, hence making the findings not representative enough; however vital lessons can be drawn.

This study went beyond its scope, to find out the patient's perspective of the diseased process and its impact on their daily activities. The interview with the participants was recorded. One hundred and sixty one patients did not have retinopathy of the 313 patients studied. The 151 found with different grades of retinopathy ranging from mild preproliferative to severe proliferative described a range of symptoms: blurring of vision always an indication of poorly controlled blood sugar prompted patient to see the doctor, double vision and floaters and its impact on their daily activities like reading, typing, cooking, trading, fishing, driving and sewing. The impact of visual impairment was prominent in the participants with clinically significant macula oedema and proliferative retinopathy leading to loss of one's independence, suffering, rejection, emotional and psychological trauma. This is devastating for those who experienced it and a great concern on viewing the video clip.

Night driving was raised as particularly problematic. Several participants admitted to having trouble driving at night; a few stopped driving at night. Although the participants knew that their vision was impaired and that they had "problems seeing at night", they did not seem to express feelings of guilt about driving despite these visual limitations. Mobility and depending on others for transportation was the most bothersome.



## 7.0

## CONCLUSION

- The prevalence of diabetic retinopathy in this study population was 49%.
- NPDR with CSME was the commonest fundus finding amongst participants.
- Long duration of diabetes mellitus, poor glycaemic control, and hypertension were associated with diabetic retinopathy.
- The majority of patients had seen an 'eye doctor' (90.7%), but only about 30% had had eye examination.
- Majority 76% had knowledge that DM affects the eye but few knew about diabetic retinopathy. The main source of knowledge was the health facility.

## **8.0 RECOMMENDATIONS**

- Existing diabetic service delivery centers country-wide should be strengthen.
- Hospital based study with a larger sample size using systematic sampling method.
- Population and rural based studies needs to be conducted to determine the burden of disease in the near future.
- Cost reduction on investigations FBS and HbA1c.
- There is the need for awareness creation among diabetic patients on diabetic eye disease.

1. International Diabetes Federation (IDF), Diabetes Atlas, 2<sup>nd</sup> and 3<sup>rd</sup> edition, updated Nov. 2006 [www.idf.org](http://www.idf.org) (Accessed May 2008)
2. Vision 2020 priority eye diseases. [http://www.who.int/ncd/vision\\_2020\\_action\\_plan/documents/V2020](http://www.who.int/ncd/vision_2020_action_plan/documents/V2020) (Accessed May 2008)
3. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes, estimates for the year 2000 and projections for 2030. *Diabetes Care* 2004;27:1047-1053.
4. Amoah AG, Owusu SK, Adjei S. Diabetes in Ghana a community based prevalence study in Greater Accra. *Diabetes Res Clin Pract* 2002;56:197-205.
5. Gordon JJ, Darwin CM, Robert AW, Sheila KW. The epidemiology of eye disease. Arnold Publishers London. Ed 2<sup>nd</sup> 2003;20:346-350.
6. Rani PK, Raman R, Subramani S, Perumal G, Kumaramanickavel G, Sharma T et al. Knowledge of diabetes and diabetic retinopathy among rural populations in India, screening model for rural population. *Rural Remote Health* 2008;8:838.
7. Agarwal S, Mahajan S, Rani PK, Raman R, Paul PG, Kumaramanickavel G et al. How high is the non-response rate of patients referred for eye examination from diabetic screening camps? *Ophthalmic Epidemiol* 2005;12:393-394.
8. Public Health Focus: Prevention of Blindness Associated with Diabetic Retinopathy. 1993;42; 191-195.
9. Dandona R, Dandona L, John RK, McCarty CA, Rao GN. Awareness of eye diseases in an urban population in southern India. *Bull WHO* 2001;79:96-102.
10. Rani PK, Raman R, Agarwal S, Paul PG, Uthra S, Margabandhu G et al. Diabetic retinopathy screening model for rural population. Awareness and screening methodology. *Rural Remote Health* 2005;5:350.
11. Parveen K, Clark M. Kumar & Clark Clinical Medicine. Elsevier Saunders UK. Ed 6<sup>th</sup> 2005;19:1101.
12. Kasper DL, Fauci AS, Longo DL, Braunwald E. Hauser S, Jameson LJ et al. Harrison's Principles of Internal Medicine. McGraw-Hill Medical Companies UK. Ed 16<sup>th</sup> 2005;2152-2153.

13. Hamilton AMP, Uibig MW, Polkinghorne. Management of Diabetic Retinopathy. BMJ publishing group London. Ed 1<sup>st</sup> 1996;257-281.
14. International Diabetes Federation (IDF), Diabetes Atlas, 4<sup>th</sup> edition, updated 2010 [www.idf.org](http://www.idf.org) (Accessed July 2010).
15. WHO. [http://www.who.int/diabetes/facts/world\\_figures](http://www.who.int/diabetes/facts/world_figures) (Accessed 2008 May).
16. Robyn JT, Jonathan ES. Australian diabetes, obesity and lifestyle study. The prevalence of and factors associated with diabetic retinopathy in the Australian population. *Diabetes Care* 2003; 26:1731-1737.
17. Rema M, Premkumar S, Anitha B, Deepa R, Pradeepa R, Mohan V et al. The Chennai Urban Rural Epidemiological Study I. Prevalence of diabetic retinopathy in urban India. *Invest Ophthalmol Vis Sci.* 2005;46:2328-2333.
18. Kariuki MM, Kollmann HM, Adala HS. The prevalence, pattern and associations of Diabetic Retinopathy among black African diabetics attending the medical diabetes clinic at Kenyatta National Hospital. *German Med. Sci* 2004.DOC 04dog SO 08.06.
19. Githeko AK, Kollmann HM, Adala HS. Prevalence, pattern and Risk factors of Diabetic Retinopathy among Diabetic patients attending peripheral health institutions in central Kenya. *East Afr J Ophthalmol.* 2007;13:4-10.
20. Nkumbe E, Kollmann KHM, Gackle HC. Fundus Findings in black Africans with newly diagnosed diabetes mellitus. *German Med. Sci* 2004.DOC 04 dog SO 08.06.
21. Mhando PA, Yudkin JS. The pattern of diabetic complications in African patients in Dar es Salaam. *Trop Geogr. Med.* 1980;32:317-323.
22. Kaimbo DK, Kabongo BK, Missotttten L. Ocular complications in diabetes mellitus in Zaire. *Bull Soc Belge Ophthalmol* 1995;25:107-113.
23. Klein R, Klein BE, Moss SE, Cruikshanks KJ. The Wisconsin epidemiologic study of diabetic retinopathy: XVII. The 14 year incidence and progression of diabetic retinopathy and associated risk factors in type 1 diabetes. *Ophthalmol* 1998;105: 977-986.
24. Dandona L, Dandona R, Naduvilath TJ, McCarty CA, Rao GN. Population based assessment of diabetic retinopathy in an urban population in Southern India. *Br J Ophthalmol* 1999;83:937-940.
25. Ferris FL. Results of 20 years of research on the treatment of diabetic retinopathy.

*Preventive Med* 1994;23:740-742.

26. Klein R, Klein BE, Moss SE, Davis MD, DeMets DL. The Wisconsin Epidemiological Study of Diabetic retinopathy II. Prevalence and Risk of diabetic retinopathy when age at diagnosis is less than 30 years. *Arch Ophthalmol* 1984;102:520-526.
27. The DCCT Research group. The effect of intensive treatment of Diabetes on the development and progression of long term complications in insulin dependent diabetes mellitus. *N Engl J Med* 1993;329:977-986.
28. United Kingdom prospective diabetes study group. Intensive blood glucose control with sulphonyureas or insulin compared with conventional treatment and risk of complications in patients with type 2 diabetes. *Lancet* 1998;352:837-853.
29. Van Leiden HA, Dekker JM, Moll AC, Nijpels G, Heine RJ, Bouter LM, et al. Blood pressure, lipids and obesity are associated with retinopathy: The Hoorn study. *Diabetes Care* 2002;25:1320-1325.
30. Ferris FL III, Chew KY, Hoogwerf BJ. Serum lipids and diabetic retinopathy. Early treatment diabetic retinopathy study research group. *Diabetes Care* 1996;19:1291-1293.
31. Root HF, Pote WH, Frehner H. Triopathy of diabetes, sequence of neuropathy, retinopathy and nephropathy in one hundred fifty five patients. *Arch Intern Med* 1954;94:931-941.
32. Kohner EM, Aldington SJ, Stratton IM, Manley SE, Hollman RR, Mathew DR, et al. United Kingdom Prospective Diabetes Study, 30. Diabetic Retinopathy at Diagnosis of Non-Insulin-Dependent Diabetes Mellitus and Associated Risk Factors. *Arch Ophthalmol* 1998;116:297-303.
33. Diabetes control and complications trial Research Group. Effect of pregnancy on microvascular complications in the diabetes control and complications trial. *Diabetes Care* 2000;23:1084-1091.
34. Wachira JW, Kollmann HM, Kimani K. Diabetic Retinopathy in pregnant and non pregnant diabetic women of child bearing age in Nairobi, Kenya. *M.Med dissertation. Department of Ophthalmology, University of Nairobi 2006.*

35. Klein BEK, Moss SE, Klein, Surawicz TS. The Wisconsin epidemiologic study of diabetic retinopathy, XIII: Relationship between serum cholesterol to retinopathy and hard exudates. *Ophthalmol* 1991;98:1261-1265.
36. Young RJ, McCulloch DK, Prescott RJ, Clarke BF. Alcohol: another risk factor for diabetic retinopathy? *Br Med J* 1984;288:1035-1037.
37. Giuffre G, Lodato G, Dardanoni G. Prevalence and risk factors of diabetic retinopathy in adult and elderly subjects: the Casteldaccia eye study. *Graefes Arch Clin Exp Ophthalmol* 2004;242:535-540.
38. Davis MD, Fisher MR, Gangnon RE, Barton F, Aiello LM, Chew EY, et al. Risk factors for high risk proliferative diabetic retinopathy and severe visual loss: early treatment diabetic retinopathy study report no.18. *Invest Ophthalmol Vis Sci* 1998; 39:233-252.
39. Qiao Q, Keinanen-Kiukaanniemi S, Laara E. The relationship between haemoglobin levels and diabetic retinopathy. *J Clin Epidemiol* 1997;50:153-158.
40. Erna EK, Barry EW. A Colour Atlas of The Eye and Systemic Disease. Wolfe Medical publications Netherlands. 1984;44.
41. Kanski JJ. Clinical Ophthalmology. A Systematic Approach. Butterworth-Heinemann USA. Ed 3<sup>rd</sup> 1994;9:287.
42. Chris Hudson. A Clinical Perspective of Diabetic Retinopathy. *Geriatrics and Aging* 2008;11:333-341.
- 43 Tien Yin Wong. The Ophthalmology Examinations Review. World Scientific Printers. Ed 1<sup>st</sup> 2001;6:185.
44. Bloomgarden ZT. Screening for and managing diabetic retinopathy:current approaches. *Am J Health Syst Pharm.* 2007;64:8-14.
45. Newcomb PA, Klein R, Klein BE. Factors associated with compliance following diabetic eye screening. *J Diabet Complications* 1990;4:8-14.
46. Diabetic Retinopathy Telescreening Systems for patients under age 30yrs, annual retinal examinations Seven-Standard field stereoscopic 30° fundus photography for assessing diabetic retinopathy.[http://www.aetna.com/cpb/medical/data/500\\_599/0563](http://www.aetna.com/cpb/medical/data/500_599/0563). (Accessed February 2010)

47. Bijlsma WR, Stilma JS. Optical coherence tomography, an important new tool in the investigation of the retina. *Ned Tijdschr Geneeskd.* 2005;149:1884-91.
48. Seyoum B, Mengistu Z, Berharu P. Retinopathy in patients of Tikur Anbessa Hospital diabetic clinic. *Ethiop Med J* 2001;39:123-131.
49. Joses M, Kiriga, Hama B, Sambo L, Sambo G, Saidou P, Barry. Economic burden of diabetes mellitus in the WHO African region. *BMC Internat Health and Human Rights* 2009;9:1.
50. Mutangana F, Kariuki M, Kollmann M. Magnitude and pattern of Diabetic Retinopathy as seen at three Hospitals in Kigali, Rwanda. *M.Med Dissertations Department of Ophthalmology, University of Nairobi.*
51. Guadie S, Kimani k, Ilako D. Magnitude and pattern of diabetic Retinopathy in Jimma University Teaching Hospital Jimma, Ethiopia. *M.Med Dissertations Department of Ophthalmology, University of Nairobi.*
52. Khandekar R, Allawati J, Mohammed, Raisi. Diabetic Retinopathy in Oman, a hospital based study. *Br J Ophthalmol* 2003;87:1061-1064.
53. Resnikoff S. Global data on visual impairment in the year 2002. *Bull WHO* 2004;82:844-851.
54. Klein R, Davis MD, Moss SE, Klein BE, DeMets DL. The Wisconsin epidemiologic study of diabetic retinopathy. A comparison of retinopathy in younger and older onset diabetic persons. *Adv Exp Med Biol* 1985;189:321-325.
55. 2010 Population and Housing Census. Ghana Stastical Service. [www.ghana.gov.gh/phc2010.pdf](http://www.ghana.gov.gh/phc2010.pdf) (Accessed December 2010)
56. The Republic of Ghana National Employment Policy-First Draft version 4 the republic of Ghana the national employment policy prepared by the ministry of manpower,youthemployment.[siteresources.worldbank.org/INTLM/Resources/Ghana\\_NATPOLICYDEC11B.pdf](http://siteresources.worldbank.org/INTLM/Resources/Ghana_NATPOLICYDEC11B.pdf) ( Accessed December 2010)
57. Levitt NS. Diabetes in Africa: epidemiology, management and healthcare challenges. *Heart* 2008;94:1376-82.
58. Mbanya JC, Motalaa AA, Sobngwi E, Assah FK, Enoru ST et al. Diabetes in sub-Saharan Africa. *Lancet* 2010;375:2254-66.

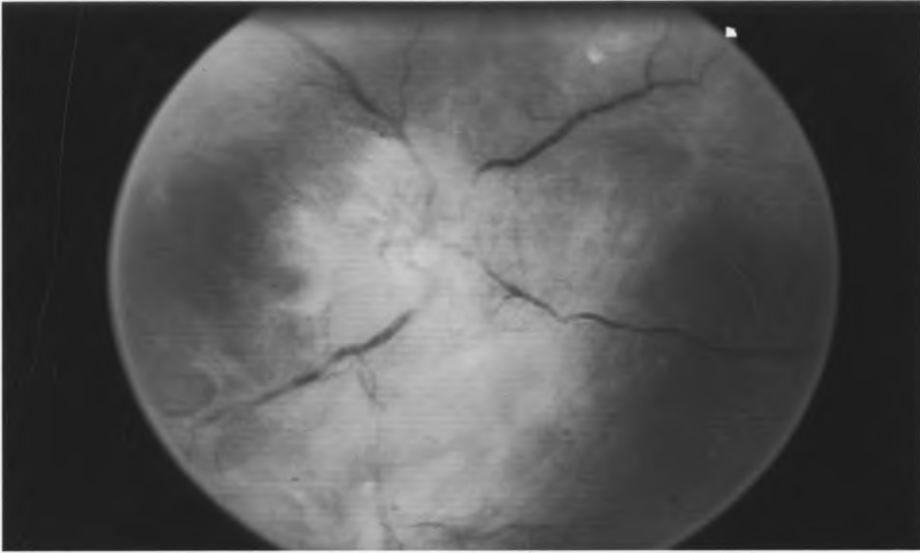
59. Ramachandran A. Socio-Economic Burden of Diabetes in India. *J Assoc Physicians India* 2007;55:9-12.
60. Chijioke A, Adamu AN, Makusidi AM. Mortality patterns among type 2 diabetes mellitus patients in Ilorin, Nigeria. *JEMDSA* 2010;15:2.
61. Ahren B, Corrigan CB. Intermittent need for insulin in a subgroup of diabetic patients in Tanzania. *Diabet Med* 1985;4:262-4.
62. McLarty DG, Swai AB, Kitange HM, Masuki G, Mtinangi BL et al. Prevalence of diabetes and impaired glucose tolerance in rural Tanzania. *Lancet* 1989;22; 1:871-5.
63. Watkins P, Alemu S. Delivery of diabetes care in rural Ethiopia: an experience from Gondar. *Ethiop Med J* 2003;41:9-17.
64. Alemu S, Watkins VJ, Dodds W, Turowska JB, Watkin PJ. Access to diabetes treatment in northern Ethiopia. *Diabetic Med* 1998;15:791-794.
65. Rwiza HT, Swai AB, McLarty DG. Failure to diagnose diabetic Ketoacidosis in Tanzania. *Diabetic Med* 1986;3:181-184.
66. Geoff G, Mbanya JC, George A. Diabetes in Africa. Biddles Limited UK. Ed 2nd 1997;13:105-110.
67. Koki G, Bella AL, Omgbwa EA, Epee E, Sobngwi E et al. Diabetic retinopathy in Black Africans: An angiographic study. *Santé* 2010;20:127-32.
68. Rabb MF, Gagliano DA, Sweeney HE. Diabetic retinopathy in blacks. *Diabetes Care* 1990;13:1202-6
69. Kay MR, Jinnat BF. Where do people with diabetes obtain information about their disease? *Diabetes Spectrum* 1999;12:136.
70. Clement S. Diabetes self-management education. *Diabetes Care* 1995;18:1204-1214.
71. Bradley C. Health beliefs and knowledge of patients and doctors in clinical practice and research. *Patient Educ Couns* 1995;26:99-106.



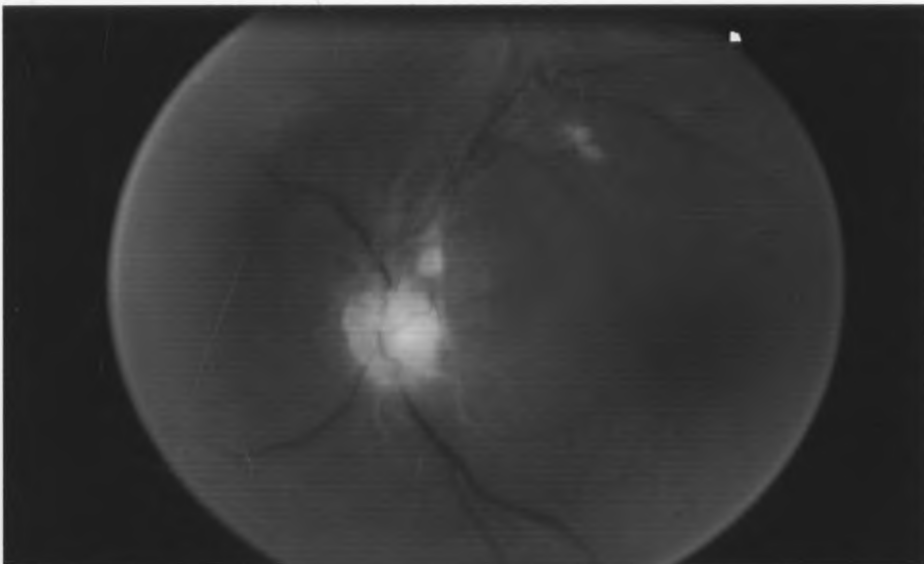
72. Maldonato A, Bloise D, Ceci M, Fraticelli E, Fallucca F. Diabetes mellitus: lessons from patient education. *Patient Educ Couns* 1995;26:57-66.
73. Brechner RJ, Cowie CC, Howie LJ, Herman WH, Will JC, Harris MI: Ophthalmic examination among adults with diagnosed diabetes mellitus. *JAMA* 1993;270:1714-18.
74. Padgett D, Mumford E, Hynes M, Carter R: Meta-analysis of the effects of educational and psychosocial interventions on management of diabetes mellitus. *J Clin Epidemiol* 1988;41:1007-30.
75. Harris MI: Medical care for patients with diabetes: epidemiologic aspects. *Ann Intern Med* 1996;124:117-22.

## 10.0 CASE REPORT OF SELECTED FUNDUS PHOTOS

OD



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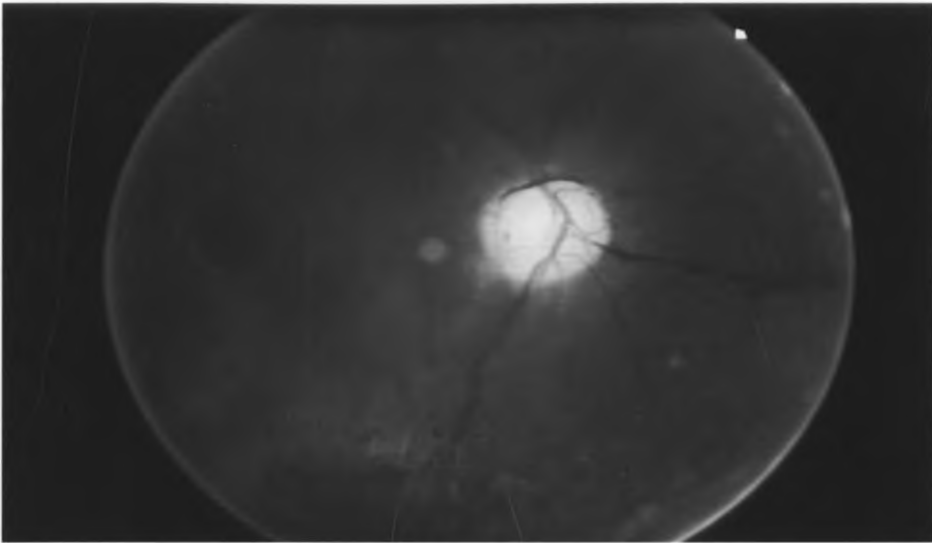
### Summary

55year old female diabetic and hypertensive for 30 and 10years respectively.

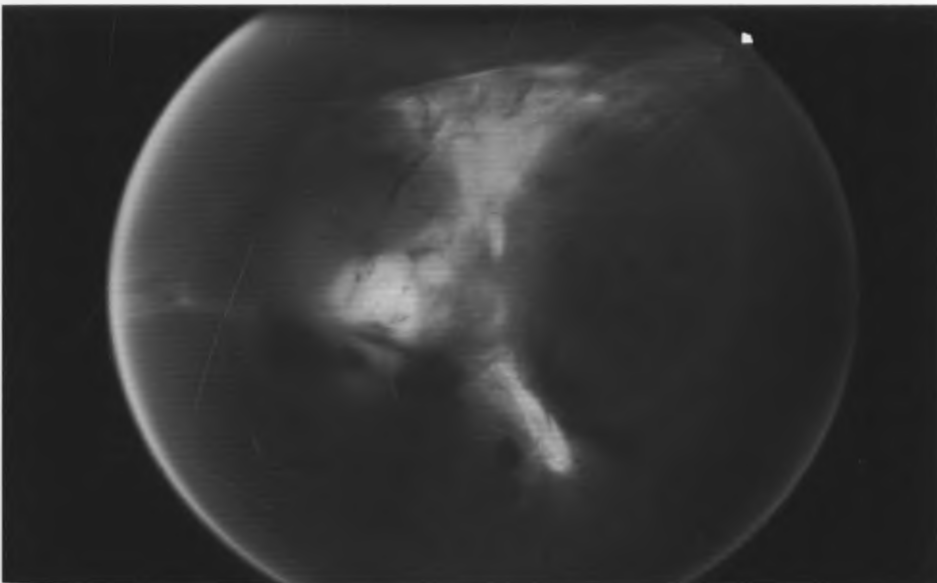
Visual acuity HM OU.

Diagnosis: bilateral tractional detachment.

OD



OS



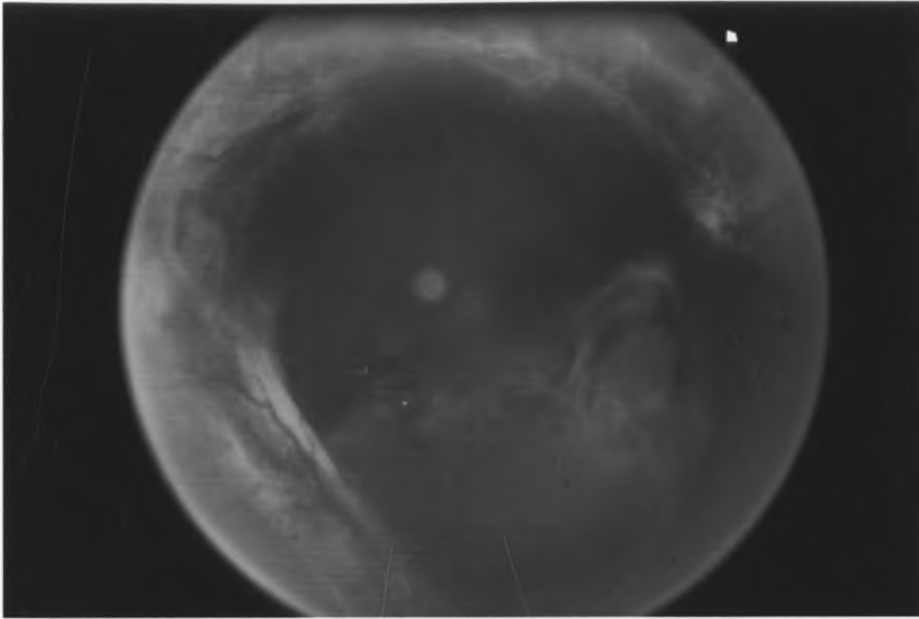
### Summary

53year old female, diabetic for 10yrs and hypertensive for 5months

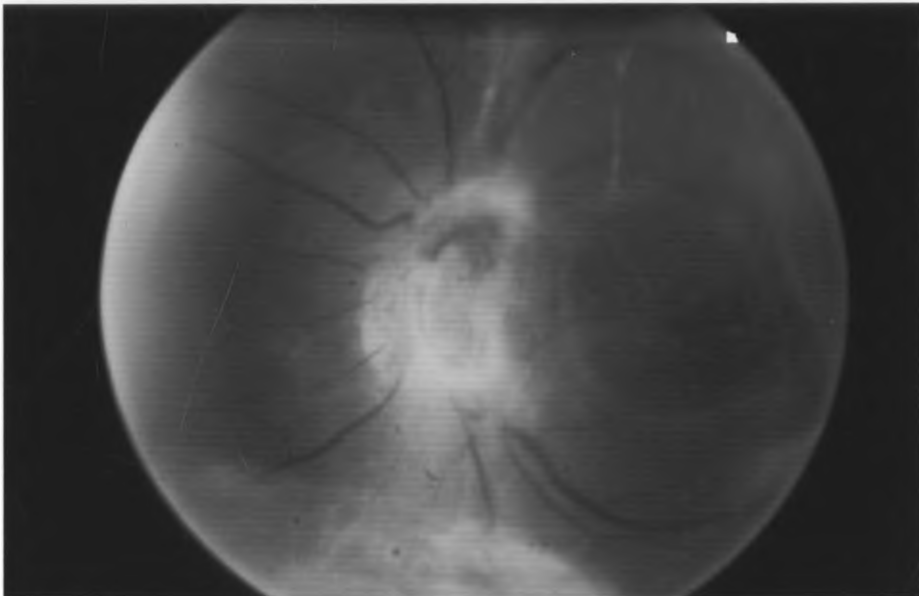
Visual acuity OS: HM; OD: PL with accurate projection.

Diagnosed: OS High Risk Proliferative Diabetic Retinopathy.

OD



OS



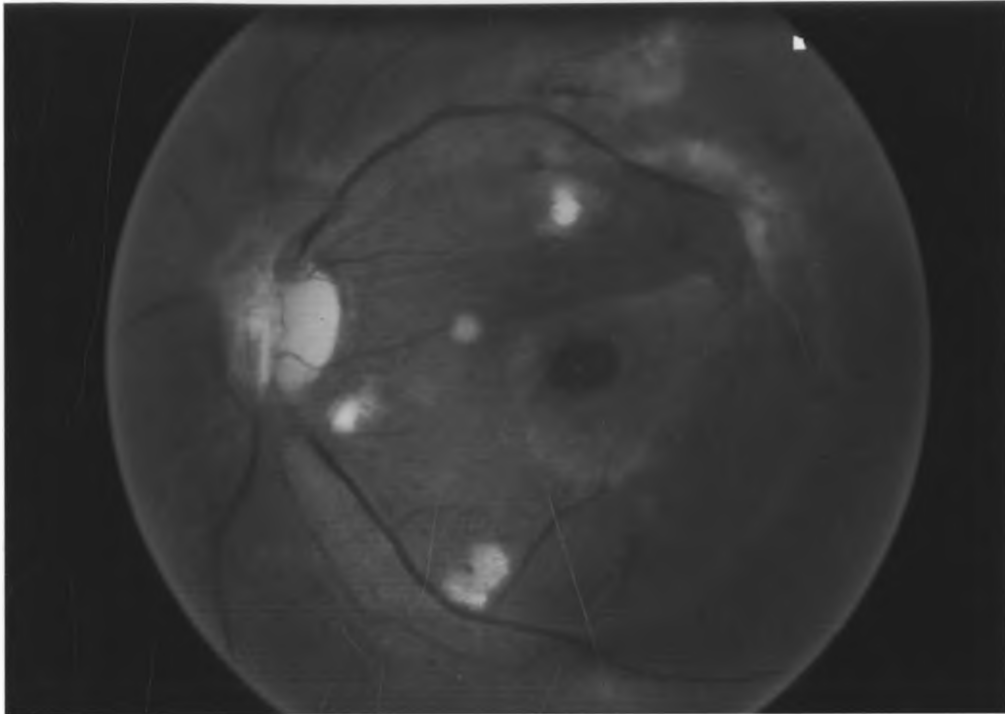
### Summary

46yrs female, diabetic for 25years and hypertensive for 5months.

Visual acuity: CF 1M.

Diagnosis: Bilateral tractional detachment.

OS



### Summary

54years old female, 25years of diabetic and 1year hypertensive.

LE VA 3/36.

Single eye

Diagnoses: Macula hole, fibro vascular proliferation.

**11.0 APPENDICES**

**11.1 APPENDIX I : QUESTIONNAIRE**

**A-GENERAL INFORMATION**

**STUDY No.**

1. AGE (in years).....

2. SEX: a) Male  b) Female

Name..... IP/OP No.....

3. Occupation.....

4. E-mail.....

5. Educational background; None  Primary  Secondary  Tertiary

6. Have you heard of Diabetes Mellitus? a) Yes  b) No

7. Is it a hereditary disease? .....

8. Can diabetes be controlled with the following?

a) Diet.....

b) O.H.A.....

c) Insulin.....

9. When was diagnosis made? .....

10. How many visits do you make per year to the physician?.....

11. Do you know the disease can affect the eye? a) Yes  b) No

12. If yes? Source of information

- a) Health facility  d) Nurse  f) Diabetologist   
b) General practitioner  e) Community nurse  g) Nutritionist   
c) Physician from diabetic clinic

OR

- g) Mass media  j) SMS  m) Press release   
h) Internet  k) Radio Station  n) Radio talks   
i) TV advertisements  l) Newspaper articles  o) Mobile clinics

Others.....

13. Have you seen the eye doctor? Yes  No

14. What took you?

- a) Visual complains (self-referral) OR Referral by the physician  
b) Others (specify)

15. Is diabetic retinopathy one of the complications of diabetes?

- a) Yes  b) No

16. Is laser treatment an option for Proliferative diabetic retinopathy?

- a) Yes  b) No

17. Any previous eye examination for the diabetes

- a) Yes  b) No

- 18. How far do you stay?
- 19. Cost of travel.
- 20. Did you come with an escort?
- 21. Concomitant illness.

- a) Hypertension
- b) Nephropathy
- c) Glaucoma

Others.....

**LABORATORY:**

Fasting blood Sugar (mmol/L).....HbA1c %.....

B/P (mmHg).....

**B-Ocular Examination,**

1. Visual Acuity OD OS

2. Adnexal & Anterior Segment

(Abnormal findings only)

3. Posterior Segment .....



## 11.2 APPENDIX II: FINAL ASSESSMENT OF DIABETIC RETINOPATHY

### USING EDTRS CLASSIFICATION

| DIABETIC RETINOPATHY                        | RE | LE |
|---|----|----|
| 0. Normal                                   |    |    |
| 1. Mild NPDR                                |    |    |
| 2. NPDR with macula edema that is not CSME. |    |    |
| 3. NPDR with CSME                           |    |    |
| 4. Severe NPDR                              |    |    |
| 5. NHRPDR                                   |    |    |
| 6. NHRPDR with CSME                         |    |    |
| 7. HRPDR                                    |    |    |
| 8. HRPDR not amenable to photocoagulation   |    |    |

11.3 APPENDIX III: CONSENT

I, Dr. Akpalu, postgraduate student, pursuing Ophthalmology with the University of Nairobi, a Ghanaian Citizen, am conducting a research on magnitude, pattern and level of awareness of diabetic retinopathy amongst diabetics attending the Korle-Bu Teaching Hospital. From anecdotal observations most of you arrived with advanced retinopathy.

I will guide you carefully through the questionnaire. Participation in this study is purely voluntary. If you wish to withdraw at any point you may do so without giving reason.

All information obtained will be treated with confidentiality at anytime.

*Thank you*

*I.....of.....do hereby consent to participate in this study. The details of the study have been explained to me and I understand well.*

*Date.....signed.....*

*I confirm that I have explained the nature of my study and I guarantee the confidentiality of the information provided by the participants.*

*Date.....Signed.....*

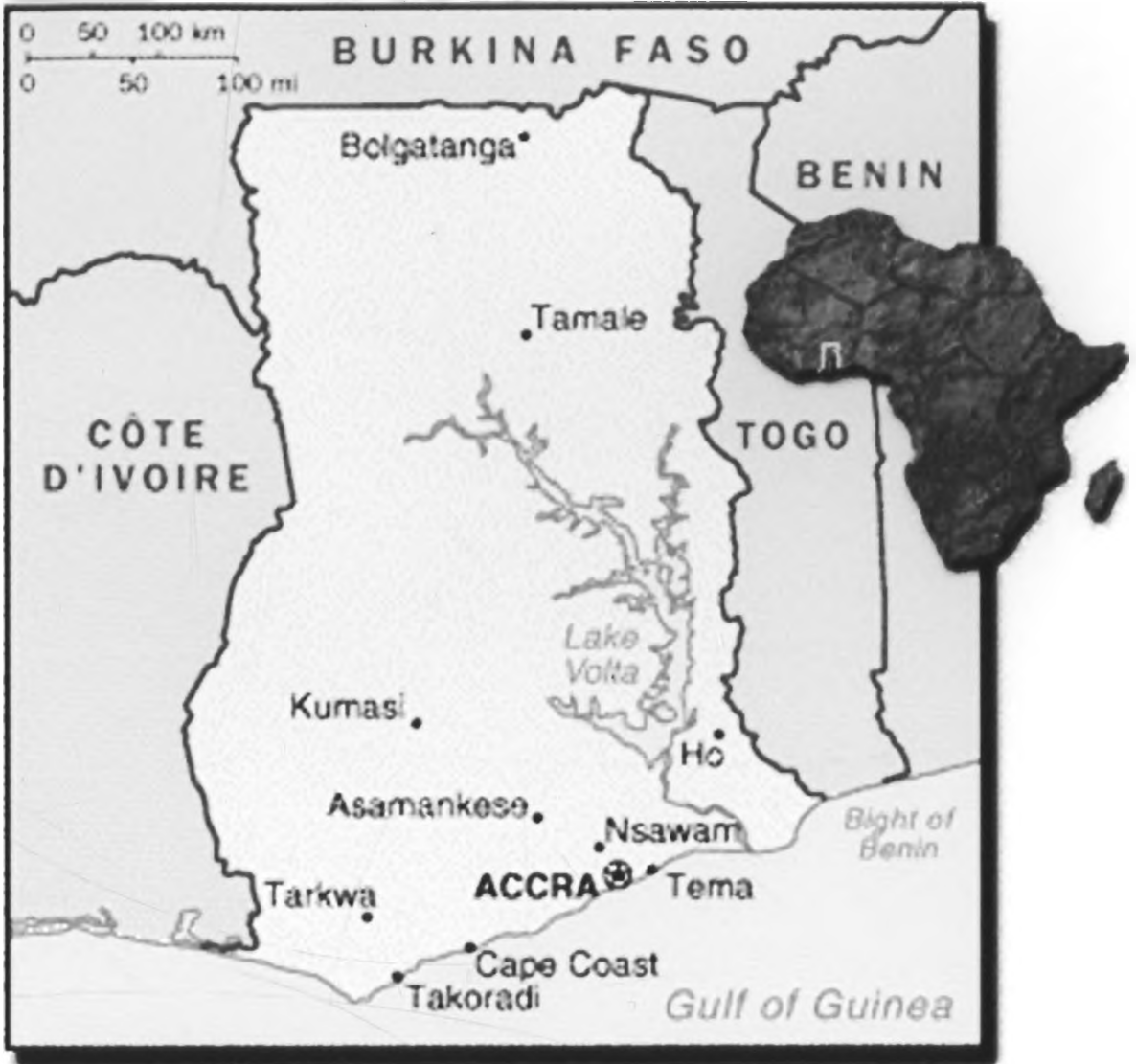
## 11.4 APPENDIX V: MATERIALS & INSTRUMENTS

- Structured Questionnaire (Appendix I)
- Pens and A4 sheets
- Automatic wrist blood pressure machine
- Sphygmomanometer and Stethoscope.
- Snellen's chart literate and illiterate
- Torches, Spotlight with batteries and spare bulbs
- Mydriatics : Tropicamide, Cyclopentolate 5% and Phenylephrine 1%
- Local Anesthetic eye drop: 0.5% Tetracaine Hydrochloride
- Fluorescein Strips, Goldmann applanation tonometer
- Direct, indirect ophthalmoscope and Retinoscope
- Loupes +20D, +90D
- Slit lamp, Spirit and dry gauze
- Fundus Camera, Computer Laptop and flash disc
- Digital Recorder / Camera

11.5 APPENDIX VI: Map of Ghana. Location of Accra



# GHANA



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