DETERMINANTS OF DIABETIC RETINOPATHY IN JIMMA UNIVERSITY MEDICAL CENTER, SOUTH WEST ETHIOPIA

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ABSTRACT

Background: Diabetic retinopathy (DR) is a vascular disease of the retina which affects patients with diabetes mellitus. Since Diabetic Mellitus patients are suffering from different complications like Diabetic retinopathy and in many developing countries little attention was given to identify the determinant factors that contributed for the occurrences of diabetic retinopathy.

Objective: To identify determinants of Diabetic Retinopathy in Jimma University Medical Center

Methods: A case-control study was conducted from March 10-May 09, 2018. Diabetic patients who developed and diagnosed as retinopathy were the cases and diabetic patients free of retinopathy were controls. Cases were those with diabetic retinopathy and controls were those free of diabetic retinopathy confirmed by physicians and for data collection, record review and interviewer administered questionnaire was used. Then systematic random sampling was used to select sample of 311(106 cases and 205 controls). Data was coded and entered in to Epi-data version 4.1 and then exported to SPSS 20 for analysis and data was presented with tables. Variables with P-values< 0.25 in binary logistic regression was selected as a candidate for multiple logistic regressions to determine independent determinants of diabetic retinopathy. Odds ratio was calculated with 95 % CI to show strength of association and P-value < 0.05 was used to declare statistical significance.

Result: A total of 311(106 cases and 205 controls) DM patients who follow at Jimma University medical center were interviewed with response rate of 97.79%.After multiple logistic regression analysis, being ≥60years of age (AOR=5.04,[95%CI: 1.83,13.87]),being illiterate(AOR=7.17[95% CI:2.61,19.7]), Poor adherence to medication (AOR =3.00[95% CI: 1.29,6.95]), high Systolic Blood Pressure (AOR=3.38[95% CI :1.26,9.05]), having family history of Diabetes Mellitus (AOR=3.95[95%CI: 1.64,9.54]), having other micro vascular complications (AOR=3.76[95% CI: 1.33,10.66]), poor glycemic control (AOR=9.08[95%CI: 3.7,22.29]), poor cholesterol control (AOR= 0.21[95%CI: 0.08, 0.51]) and being anaemic (AOR= 2.8[95%CI: 1.05, 7.47]) were the independent predictors of diabetic retinopathy.

Conclusion and recommendation: from study participants; older age ≥ 60 years, those of no formal education patients, Poor adherence to medication, high Systolic Blood Pressure, having family history of Diabetes Mellitus, having other micro vascular complication, poor glycemic control, poor cholesterol control and being anaemic patient were the independent predictors of diabetic retinopathy. Jimma University medical center and concerned body should give more attention to older age, take care for illiterate patients to make well informed, work on those of poorly adhered to anti-diabetic patients, inform patients with high systolic blood pressure to follow their blood pressure regularly. Patients withfamily history of Diabetes Mellitusand who have other micro vascular complication should be well handled and treated fairly without any negligence. Finally, blood sugar control, blood serum cholesterol control is mandatory and prevention of anaemia is best option.

Key words: *Diabetic Retinopathy, determinants, Jimma University medical center*

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ABBREVIATIONS AND ACRONYMS

- AOR _____Adjusted Odds Ratio
- BMI_____Body Mass Index
- BP_____Blood Pressure
- CSME_____clinically significant macular oedema
- DBP_____Diastolic Blood Pressure
- DM_____Diabetic Mellitus
- DR_____Diabetic Retinopathy
- ETDRS -------Early Treatment Diabetic Retinopathy Study
- FBS_____Fasting Blood Sugar
- HTN_____Hypertension
- ICDSS ---------International Clinical Disease Severity Scale
- IGR_____ Impaired Glucose Regulation
- JUSH_____Jimma University Specialized Hospital
- OR_____Odds Ratio
- NPDR_____Non- Proliferative Diabetic Retinopathy
- PDR----------Proliferative Diabetic Retinopathy
- RBS_____Random Blood Sugar
- SBP_____Systolic Blood Pressure

1. INTRODUCTION

1.1. Background

Diabetic retinopathy is a primary problem of eye injury in working-age adults (1). Diabetic Retinopathy is the specific micro-vascular complication of DM and affects 1 in 3 persons with Diabetic Mellitus(2)**.**World Health Organization (WHO) reported that good controlling of high blood sugar and high blood pressure significantly minimizes the risk for diabetic retinopathy(3). Major predictors of diabetic retinopathy are the diabetes duration, hyperglycemia, high blood-pressure, lipid disorders, pregnancy and puberty, age at diagnosis, ethnicity and family history among others. Diabetic retinopathy develops as a consequence of long-term accumulation of damage of retinal vessels (4).

Diabetic retinopathy is neurovascular problem of both type1 and 2 diabetes, of which strongly associates to both the duration of diabetes and level of glycemic control. Diabetic retinopathy is the most common cause of new cases of blindness among adults aged 20–74 years in industrialized countries (5). It has been seen that patients having Diabetic Retinopathy are 25 times more at risk of blindness than a non-diabetic individual. Timely diagnosis with the help of better screening and referral facilities, strict control of systemic factors and timely intervention in the form of medical and surgical intervention can delay the sight threatening complication of DR(6).

In Ethiopia the available limited material and human resource are directed towards efforts to combat infectious diseases. Hence little is known about diabetic retinopathy even most of the studies were on prevalence in which limited variables was used to measure of diabetic retinopathy and there is no any studies done on the determinants of diabetes mellitus especially on Diabetic Retinopathy. Therefore, this study was conducted to assess the determinants of Diabetic Retinopathy in Jimma University Medical Centre South Western Ethiopia. Based on this information intervention towards combating and reducing prevalence and determinants of diabetic retinopathy can be designed and evaluated accordingly by stakeholders.

1.2. Statement of the problem

Diabetic retinopathy (DR) is the major long-term complication of diabetes and main cause of vision impairment and vision loss(4). The risk factors are like poor glycemic control, Hypertension, Nephropathy, Hyperlipidemia, Anemia, poor adherence to exercise, duration of Diabetic Mellitus(DM), Residual beta cell function, Genetic predisposition, Insulin resistance are the main contributors for the development diabetic retinopathy(6).

Seventy-nine point three percent (79.3%) of individuals with type 1 and 82.6% of type 2 diabetes had evidence of ever having had a Diabetic Retinopathy, with over 50% having had their latest screen in the 15 months prior to the end of their follow-up period(7).

Diabetic retinopathy is accountable for 4.8% of the 37 million cases of blindness due to eye diseases all over the world (i.e. 1.8 million persons)(8). The quantity of blindness due to diabetic retinopathy ranges from close to 0% in most of Africa, to 3–7% in much of South-East Asia and the Western Pacific, to 15–17% in the wealthier regions of the Americas, Europe and the Western Pacific(9).

At least 171 million people worldwide have diabetes, and this number is likely to more than double by the year 2030, to 366 million (10). About50% of persons with diabetes have no any knowledge of having condition, although about 2 million deaths every year are attributable to complications of diabetes. After 15 years, about 2% of persons with diabetes become sight and about 10% develop severe visual loss. After 20 years, more than 75% of patients will have some form of diabetic retinopathy(11).

Diabetic retinopathy accounts about 1.9% of moderate or severe visual problem world wide and 2.6% of blindness in 2010. However, retinopathy rates are higher in type 1 diabetes, people of longer duration of diabetes and among people of lower socioeconomic status (3).

The main risk factors of diabetic retinopathy are hypertension, low hemoglobin, high systolic blood pressure (SBP), pulse pressure, serum lipoprotein level and body mass index (BMI). Additionally, renal disease/nephropathy, genetic factors, high waist-hip ratio (abdominal obesity), upper socioeconomic status, urban residence, male gender, insulin treatment and pregnancy was also another risk factors of diabetic retinopathy(12).

A Global meta-analysis study reported that 1 in 3 had any form of Diabetic Retinopathy in the US, Australia, Europe and Asia. It is also reported that 1 in 10 (10.2%) had vision threatening Diabetic Retinopathy (VTDR) and it was associated with poor control of blood sugar, blood pressure, and

blood lipids(2). In richer countries diabetic eye disease is among the leading and the fifth leading cause of global blindness, affecting an estimated 1.8 billion people(13).

In Oman the prevalence diabetic retinopathy was 4.4% , men, longer duration of diabetes and those with co-morbidities such as nephropathy, hypertension, and Neuropathy had significantly higher rates of diabetic retinopathy (14). Study in Rumania reported that “the risk factor correlated with Diabetic Retinopathy progression was anemia, hypertension and diabetes duration were in type 1 and smoking status at diabetes diagnosis in type 2 diabetes”(15).

In Saudi prevalence of diabetic retinopathy was 19.7% and duration of diabetes and age were the most significant risk factors for diabetic retinopathy. Nephropathy, neuropathy, insulin use, poor glycemic control, hypertension and male gender significantly increased the risk for diabetic retinopathy but smoking, hyperlipidemia and obesity significantly reduced the risk for diabetic retinopathy(16).

In Ethiopia diabetes suffering around 2.1million people, from these the prevalence of adults is4.8%,and the prevalence of Diabetic Retinopathy was 39%(17). From review of the existing evidences, determinants of Diabetic Retinopathy among diabetic patients on follow up in the Ethiopian care setups have not been well documented generally and there are limited studies that determine factors associated with diabetic retinopathy in Jimma, in particular.

2. LITERATURE REVIEW

2.1. Overview of Diabetes Mellitus and its complications

Diabetes mellitus is the commonest of all metabolic diseases all over the world. The global prevalence of diabetes mellitus has increased dramatically over the past decades from an estimated 30 million cases in 1985 to 177 million in 2000. The current estimate suggested that diabetes mellitus was the 5th leading cause of death worldwide and is responsible for almost 3 million deaths per year. Based on the current report more than 360 million individuals will have diabetes by the year 2030(18).

Advancement of diabetic retinopathy depends on many risk factors. The main reason towards delayed development of diabetic retinopathy is to target the modifiable risk factors like Glycemic control, Hypertension, Nephropathy, Hyperlipidemia, Anemia, Exercise, and Pregnancy. But non-modifiable risk factors like duration of diabetic Retinopathy, Residual beta cell function, family history, Insulin resistance are the main contributors for the development diabetic retinopathy(6). The study done in Jimma shown that prevalence of diabetic retinopathy was 41.4% of these, vision threatening diabetic retinopathy was found in 7.3% of patients. Only 14.5% of the patients had prior eye check. There was a statistically significant association between diabetic retinopathy and duration of diabetes, fasting blood sugar, and systemic blood pressure(19). WHO(World Health Organization) estimates the number of cases of diabetics in Ethiopia to be about 800,000 in 2000 and projected that it would increase to about 1.8 million by the year 2030(18).

2.2. Socio demographic factors of diabetic Retinopathy

The study done in US on incidence and risk factors for developing Diabetic Retinopathy reported for each 1-year increase in age at initial Diabetic Mellitus diagnosis, the odds for Diabetic Retinopathy increased by 4.6%(20). Also the study done in Singapore shown that older age was one risk factor for diabetic retinopathy (21).

The study done in Saudi Arabia on determinants of Diabetic Retinopathy reported that the odds of having Diabetic Retinopathy increases one-and-half times and as increase in one year, the odds of having DR increases by four times(22). The risk of increasing diabetic retinopathy was decreased in women compared with men and odds of Diabetic Retinopathy was the same

between ethnic groups(7). Cohort study done at Arbaminch General Hospital 2015, revealed that hazard of developing Diabetic Retinopathy was almost seven times higher in patients with baseline age ≥60 years than their counterparts(23)(24). The study done in Korean Community 2015, on socioeconomic differences among community-dwelling diabetic adults, revealed that individuals with higher educational levels and monthly household incomes had lower risk for Diabetic Retinopathy. But those who had no formal education had high probability of developing Diabetic Retinopathy(25).The study done in Japan also dictated that odds of having retinopathy were greater among patients who had graduated from junior high school, educational attainment of lower classes was a significant risk factor for the progression of retinopathy (26)(27).The study done in Gondar shown that the urban group had significantly more retinopathy than the rural group(28). Female patients were two-times had the risk to micro-vascular complications than male subjects(29).

2.3. Medical Determinants of diabetic retinopathy

Cohort study done in UK(7)and Japan(30) revealed that the incidence rate of Diabetic Retinopathy patients increases with duration after diagnosis increases in years. The study done in Saudi Arabia revealed that poor blood lipid, poor blood cholesterol and poor glycemic control and long duration of diabetic mellitus increases the odds of having diabetic retinopathy(22).

The study done in Oman showed that, odds developing diabetic retinopathy was high in lower hemoglobin level(anemic HbA1c level ≤9%) (14). The study done in china revealed that history of Impaired Glucose Regulation and renal problems were highly associated with the development of Diabetic Retinopathy(32).

The study done in Singapore showed that High Blood Pressure, and higher pulse pressure increases the chance of developing Diabetic Retinopathy and higher cholesterol levels were protective of any retinopathy. Vision-threatening retinopathy also associated with heart disease and kidney disease (21). Study done in India on Diabetic Retinopathy in 2015 reported that there is high risk of Diabetic Retinopathy in patients of Diabetic Mellitus-type-I when compared to Diabetic Mellitus Type-II patients(6).

A study done in Khartoum in 2015 showed that duration of Diabetic Mellitus of more than 10years have more than double risk and having hypertension triples the risk of retinopathy(33).

The study done on the Chronic diabetic complications in Africa ,2011 reported that there was a strong association with long duration of diabetes, highest fasting plasma glucose (FPG) level(34). The longitudinal study conducted at Arbaminch General Hospital also revealed that hazard of developing Diabetic Retinopathy was higher for patients with baseline Systolic Blood Pressure level ≥140 mmHg, high fasting plasma glucose level and with family history of diabetes (23,24).

The study done in northwest of Gondar showed that there was a highly significant association of hypertension with diabetic retinopathy(28).

The study done in Jimma University Specialized Hospital revealed that Subjects with evidence of genetic predisposition had three-times odds for the diabetic complications and those patients with poor glycemic level (HbA1C: between 8.1% and 10.0%) had double odds of micro vascular complication and it is 92% less likely for developing DR for patients with duration of diabetes 6 years and above than their counterparts(29).

The study done on Prevalence of diabetic retinopathy in Jimma University Hospital, Southwest Ethiopia revealed that prevalence of diabetic retinopathy was 41.4%. Vision threatening Diabetic Retinopathy was found in 7.3% of patients. There was a statistically significant association between diabetic retinopathy and duration of diabetes, fasting blood sugar, and systemic blood pressure(35). Cohort Study in China high Systolic Blood Pressure doubles the probability of Diabetic Retinopathy(36). Cohort study in Korea also suggests that high Systolic Blood Pressure is one of risk factors for the development of Diabetic Retinopathy(37) and in rural India systolic blood pressure of ≥140 mm Hg have a double odds of developing Diabetic Retinopathy(38).

The study done in high-risk China population(32) revealed renal problem was one of the risk factors associated with Diabetic Retinopathy. The study conducted in India also suggests that renal complication was significantly contributed higher probability for Diabetic Retinopathy(39). The systematic review done in Singapore National Eye Centre with Singapore Health Service revealed that Haemoglobin level of less than 6%) has significantly higher mortality rate and high probability of Diabetic Retinopathy(40).

Cohort study done in china showed that individuals who had haemoglobin above cut of point were about twice risk of developing Diabetic retinopathy than their counter parts(36). Study

done in India suggests that Individuals with anaemia were more likely to develop Diabetic Retinopathy than individuals without anaemia(39).

2.4. Behavioral factors of diabetic retinopathy

The study done on the prevalence of and major risk factors associated with diabetic retinopathy in Armenia revealed that unadjusted analysis showed no significant association between Diabetic Retinopathy use of medication for controlling diabetes, smoking, and physical activity. But odds of having Diabetic Retinopathy were higher among those who were treated with insulin compared to patients treated with other glucose controlling medication(41).

The study done in Japan suggests that there was a higher prevalence of diabetic retinopathy among alcohol drinkers (26) and study done in Nepal revealed that alcohol consumers were four times higher were found highly associated with odds of developing any type of Diabetic Retinopathy(42).

In rural India adherence to medication had no any significant association with development of diabetic retinopathy(38), the study done Gegharkunik province of Armenia also reported that adherence to anti-diabetic drugs was had no any significant contribution to occurrence of diabetic retinopathy(41), in Sudan Khartoum taking Oral hypoglycemic was not significant association to Diabetic Retinopathy(33).

2.5. Conceptual frame work

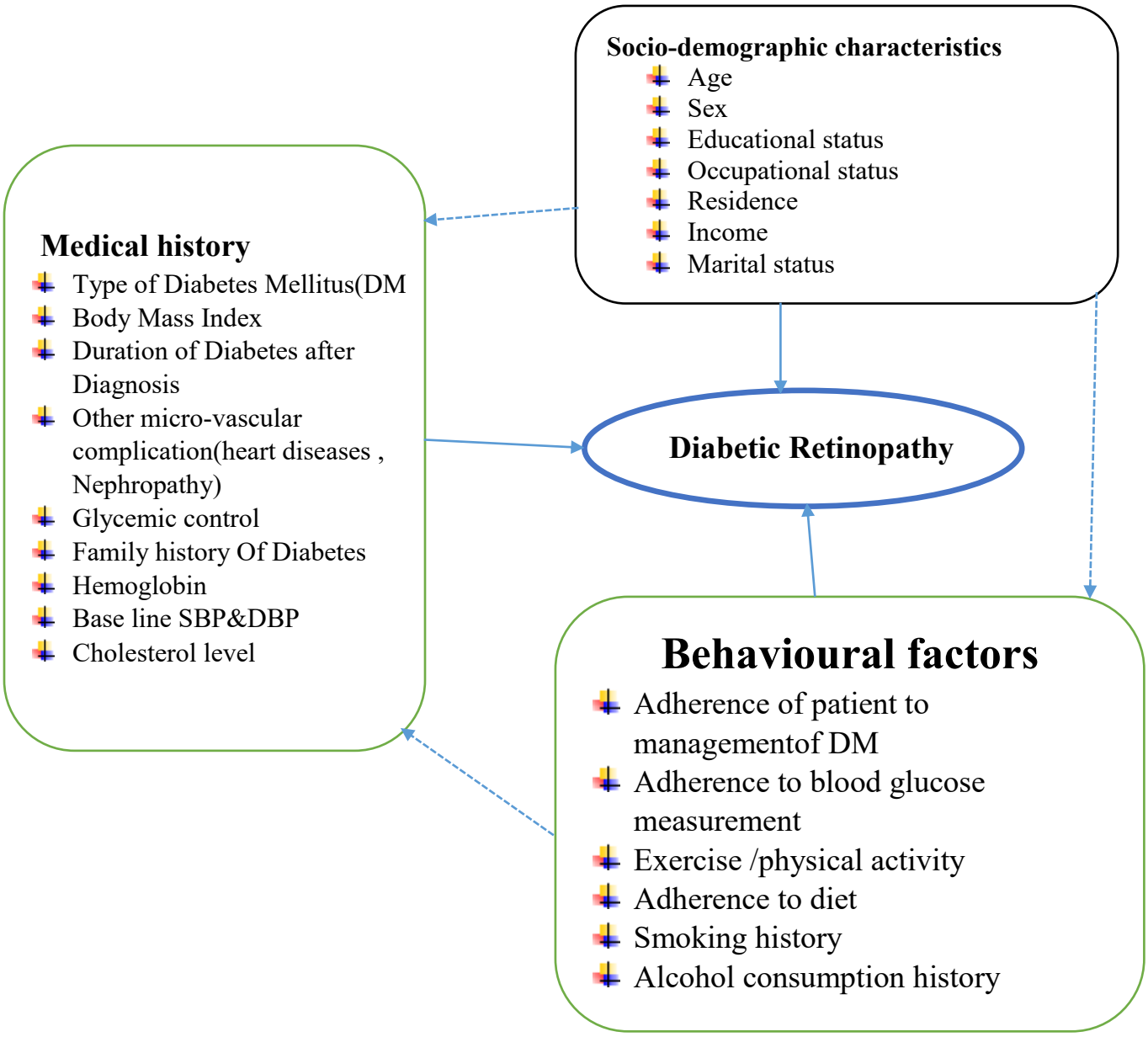

Figure 1.the conceptual frame work of determinants of diabetic Retinopathy developed after reviewed different literatures

References:- (23,24, 28, 34, 35, 38)

2.6. Significance of the study

Most of Developing countries including our country Ethiopia are prioritized that, controlling chronic non-communicable diseases like Diabetes Mellitus could be one way of eradication of extreme poverty and promoting health. Some what little effort was carried out to manage and identify the possible measures for general Diabetic patients. However, the concern of Diabetic retinopathy and possible determinant factors are the big issues to be given high priority for all diabetic patients on follow-up.

Therefore, the study seeks to reveal further considerations in this field to the policy makers, scholars and development agencies. The determinant factors identified in this study will be essential to all those who work on interventions in the Non-Communicable Diseases Control (NCDC) area.

Jimma University medical center can also gain knowledge from the study to plan contextually appropriate Diabetic retinopathy screening, prevention, treatment and control interventions using the findings of the study specifically to see the determinants of diabetic retinopathy for specific public health interventions aims to improve the extent of visual ability of diabetic patients. The study participants also get information on the benefit of regular screening, being adhering to the advice of the physicians regarding diet, drugs, and necessary modification. The study will also identify important programmatic areas for interventions targeted at minimizing Diabetic Retinopathy and blindness due to diabetes and can serve as a baseline for further researchers for the study area.

3. OBJECTIVE OF THE STUDY

- To identify Determinants of Diabetic Retinopathy in Jimma University Medical Center, Oromia, Ethiopia, 2018.

4. METHODS AND MATERIALS

4.1. Study setting/area and Study period

The study was conducted in Jimma University Medical Center at outpatient clinic from March 10-May 9, 2018. The Hospital is located in Jimma City, 335 km Southwest of Addis Ababa and it is a specialized hospital that gives health service for more than 10 million people living in Southwest Ethiopia. The hospital has many chronic follow-up clinics for both pediatric and adult patients. The diabetes clinic runs twice weekly (on Monday and Tuesdays) and provides integrated diabetic care for both Type 1 and Type 2 diabetics. In the hospital there are around 3020 diabetic patients who follow treatment. From these, 946 patients are with diabetic Retinopathy and around 1605 of the patients are free of retinopathy. The weekly diabetic follow-up clinic gives service to 70-90 patients per day.

4.2. Study design

A facility based case control study was conducted.

4.3 Population

4.3.1. Source population

The source population of this study was all diabetic patients who follow at Jimma University Medical center.

4.3.2. Study Population

Cases: -Diabetic patients with diabetic retinopathy diagnosed by ophthalmologists and eligible for the study during data collection time.

Control: - Diabetic patients free of retinopathy decided by ophthalmologists and eligible for study during data collection time.

Case Definitions

For cases:-Diabetic patient of any of characteristic lesion: micro aneurisms (Mas), hemorrhage, hard exudates (HE), venous beading and new vessels on retina suggested as to be diagnosed and confirmed as having diabetic retinopathy by physicians or ophthalmologists(22),(40)

For controls:- Diabetic patient of free from any of characteristic lesion: micro aneurisms (Mas), hemorrhage, hard exudates (HE), venous beading and new vessels on retina suggested as to be diagnosed and confirmed as free from diabetic retinopathy by physicians or ophthalmologists(23,40).

4.4. Eligibility criteria

4.4.1. Inclusion criteria

Inclusion Criteria for cases and controls

- All diabetes patients age greater than 15 years.
- All diabetes patients who were diagnosed as diabetic retinopathy for cases and diagnosed as free of diabetic retinopathy for controls.
- DM patients who had at least three times follow up.

4.4.2. Exclusion Criteria for cases and controls:-

- Diabetic patients those who are critically ill, diagnosed mental illness and unable to communicate

4.5. Sample size and Sampling technique

Sample size was determined by using Epi Info statistical software to determine two population proportion from the factors reviewed which gives maximum value(29) by using 95% CI, power 80%, case to control ratio 1:2, Odds Ratio = 2.55 which is the ratio of odds of Base line Diastolic Blood Pressure among patients with retinopathy to odds of Base line Diastolic Blood Pressure among patients free of retinopathy `, expected prevalence of Base line Diastolic Blood Pressure among patients free of retinopathy = 9.47% and probability of exposure to Base line Diastolic Blood Pressure among patients with retinopathy as 21.1 %.

Parameters used to calculate sample size were:

- **λ**=ratio of free diabetic retinopathy to diabetic retinopathy
- p1= expected frequency of Base line Diastolic Blood Pressure among diabetic patients with diabetic retinopathy=21.1 %.
- p2= expected frequency of Base line Diastolic Blood Pressure among diabetic patients with free of diabetic retinopathy =9.47%
- n1 =sample size for diabetic retinopathy=101
- n2= sample size for free of diabetic retinopathy =202
- Zα/2=standard normal value at 95%CI=1.96 and Z/1-β (power)=80%

The calculated sample was 303 (101 cases and 202 controls). By adding 5% non-response rate, the total sample size was 318 (106 cases and 212 controls).

Table 1.shows factors that reviewed for maximum sample size.

	Factors reviewed	% of exposure among cases	% of exposure among controls	Odds ratio (OR)	Sample size			References
					Cases	controls	Total	
1.	Baseline DBP level(mmHg)	21.1	9.47	2.55	101	202	303	(29)
2.	Poor control of glycemic(mmHg)	25.8	10.6	2.93	68	135	203	(29)
3.	Duration of diabetes (year)	38.33	16.67	3.10	46	92	138	(24)
4.	Baseline SBP level (mmHg)	33.33	11.11	3.99	36	72	108	(23)
5.	Baseline age (year)	47.22	14.10	5.45	21	41	62	(24)

4.6. Sampling procedures

Cases were selected from diabetic retinopathy patients and controls from free of retinopathy diabetic patients by Systematic random sampling from ever enrolled diabetic patients on diabetic follow-up as a sampling frame.

For Controls: - K= N/n where N was total number of Diabetic retinopathy free patients, n=number of sample size K= 1605/318 which was5 from the list of 1 to 5 the first DM patient, the 4rth patientwasselected by using lottery method, then data wascollected from every 5th patients starting from number fourth patient free of diabetic retinopathy by systematic random sampling until the required sample size fulfilled

For Cases; -K= N/n where N was total number of Diabetic retinopathy patients, n=number of sample size K= 946/318 which was3 from the list of 1 to 3 the first DM patient, the 2nd patientwasselected by using lottery method, then data wascollected from every 3rdpatientsstarting from number 2nd patient of diabetic retinopathy by systematic random sampling until the required sample size fulfilled.

4.7 Data collection procedures

First of all cases and controls were identified which were confirmed by physicians (ophthalmologists) and for data collection, record review and interviewer administered

questionnaire was used. Cases and controls were recorded by identification number. After cases and controls were differentiated, data was collected from record review/patient index card and Interview of the study participants. Checklist and structured questionnaire was used for data collection. The questionnaire was prepared in English, translated to Afan Oromo language then back translated to English. Data was collected by trained health professionals (two BSc nurses). The questionnaire was developed by the principal investigator after reviewing different literatures(3),(23),(24),(29),(36),(44),(46) which has three parts. The first part was socio demographic factors (Age, sex, residence, ethnicity, Marital status, Religion, Occupational status, Educational status, Monthly income). The second part was behavioral factors like Adherence of patient to management of Diabetic Mellitus, to blood glucose measurement, Exercise /physical activity, Regularity of diet, Smoking and Alcohol consumption history. The third part was medical history like Type of Diabetes Mellitus, Duration of Diabetes Mellitus after Diagnosis, Other micro-vascular complication, Glycemic Level, Family history, Hemoglobin, Base line Systolic Blood Pressure and Diastolic Blood Pressure, Cholesterol level, weight, height, which was measured by data collectors during data collection or measurements recorded on patient's individual folders during data collection. Measurement procedures of following variables was carried out as follows.

Diabetic retinopathy: the investigation was carried by ophthalmologists using slit lamp by dilating fundus examination using 1% tropic amide eye drop and diabetic patients who were considered to have damaged retinal blood vessels diagnosed and confirmed as diabetic retinopathy(33).

Weight was measured in light closing and without shoes in kilograms (kg) using calibrated digital weighing scale at a precision of 0.1kg as per recommended but not repeated measurements.

Height was measured using Stadiometer in centimeter (cm) in erect position that the back of the head, shoulder blades, buttocks, and heels make contact with the backboard at a precision of 0.1cm with shoes removed as per recommended but not repeated measurements.

Blood pressure was measured using a mercury sphygmomanometer with a cuff deflation rate of 2mmHg. Two measurements from left arm 5 minutes apart in sitting position was averaged to be recorded.

4.8. Study variables

4.8.1. Dependent variable

- ❖ Diabetic retinopathy

4.8.2. Independent variables

- **Socio-demographic variables**: Age, Sex, Educational status, Occupational status, Residence, Income and Marital status
- **Behavioral factors:** Adherence of patient to management of Diabetes Mellitus, Adherence to (blood glucose measurement, Exercise /physical activity, Regularity of diet), Smoking and Alcohol consumption history
- **Medical history:** Type of Diabetic Mellitus, Body Mass Index, Duration of Diabetes Mellitus after Diagnosis, Other micro-vascular complication, Family history of Diabetic mellitus, Hemoglobin, Base line Systolic Blood Pressure and Diastolic Blood Pressure, Glycemic level and serum cholesterol level.

4.9. Operational definitions and definition of terms

- **Diabetic retinopathy :**Diabetic patient of any of characteristic lesion: micro aneurisms (Mas), hemorrhage, hard exudates (HE), venous beading and new vessels on retina suggested as to be diagnosed and confirmed as having diabetic retinopathy by physicians or ophthalmologists (23,40).
- **Adherence to medication:** if the patients took all his/her anti diabetic medication in last seven days.
- **Adherence to blood glucose testing at home**: if the patient measured his blood glucose for at least once every week(47,48).
- **Adherence to diet**: If the patient follow recommended diet as guideline for more than 3 days in last seven days.
- **Adherence to exercise**: If the patient did 30 minutes activity involved in walking and running for more than 3 days in last seven days(47,48).

- **Glycemic control was measured by random blood sugar.** A Diabetic Mellitus patients with>200mg/dl average random blood sugar level of the last three record was coded as poor glycemic control, if <200mg/dl were considered as good glycemic control(47,48).

- **Body mass index:** BMI was used to define **underweight** (BMI <18.5), **normal** (18.5< BMI<25.0),**overweight** (25.0< BMI<30.0), and **obesity** (BMI >30) in adults(47).
- **Systolic hypertension:** was defined as systolic blood pressure ≥140 mmHg and/or
- **Diastolic hypertension**: was defined as blood pressure ≥90 mmHg or current use of antihypertensive medication(47).
- **Alcohol consumption history**- who reported consumption of any type of alcoholic beverages within the past 12 months were considered as alcohol consumers (42),(47).
- **Other chronic complications:** the presence complications like Nephropathy, cardiac disease, hypertension diagnosed by physician(48).
- **Serum cholesterol control was measured by serum cholesterol.** a Diabetic Mellitus patients with>200mg/dl of serum cholesterol level of the record was coded as poor serum cholesterol control, if <200mg/dl were considered as good serum cholesterol control(47,48).

- **Anemia**: is the condition of having a lower-than-normal number of red blood cells or quantity of hemoglobin(<11mg/dl)(33).

4.10. Data quality management

To ensure the quality of data, a range of mechanisms was employed to address major areas of bias introduction during the data collection process. First, Data collectors were trained on how to gather the appropriate information, procedures of data collection techniques and the whole contents and subject matter of the questionnaire. A week prior to the actual data collection, the questionnaire was pre-tested on 5% (16 patients) of sample in Agaro Hospital among diabetic patients. The purpose of the pre-test was to ensure that the data collectors were familiar to the tools; the respondents were able to understand the questions, wording, and logic and skip order of the questions in a sensible way to the respondents. Amendments was made accordingly after the pre-test. Data was collected by trained two BSc Nurses and additionally supervised by one Health officer who were fluent in Afan Oromo. Daily, on site supervision by the supervisor was carried out during the whole period of data collection. At the end of each data collection day, the

questionnaire was reviewed and cross checked for completeness, accuracy and consistency by the investigator and corrective discussion was under taken with all the data collectors. Data was cleaned and edited after it is entered in to the software.

4.11. Data processing and analysis

Collected data was edited, coded and entered in to Epi-Data version 4.1 and then exported to SPSS 20 for analysis. Checking data code and data cleaning was done before analysis. Frequencies and cross tabulations was used to summarize descriptive statistics.

The association between diabetic retinopathy and each covariates was assessed first by bivariate logistic regression to identify candidate variable for final model. Variables with P-value <0.25 was taken to multiple Logistic regression.

Backward likelihood ratio with 0.1 probability removal was used to develop the model.

Odds Ratio was estimated with 95% CI to show strength of association and P-value <0.05 was used to declare statistical significance. Goodness of fit of the final model was checked using Hosmer Lemeshow test of goodness of fit considering good fit at P-value≥0.05(0.081), omnibus likelihood test <0.05(0.000) and model classification of accuracy was checked(89%).

4.12 Ethical consideration

The study was obtained ethical approval from Jimma University Institutional Review Board before its commencement. The aim of the study was explained and informed written consent was obtained from the study participants. Permission letter was obtained of Jimma University Medical Center Medical director for getting necessary information, Record reviewing and interviewing concerned individuals resides in Hospital

4.13. Dissemination of findings

The findings will be presented to the Jimma University Scientific Community and it will also be sent to Jimma University Medical Center, Ethiopian Diabetic Association and to other stake holders. The findings of the study will be published in a reputable journal to reach the wider Scientific Community. Presentations in scientific conferences and seminars will also be considered.

5. RESULT

5.1. Socio demographic characteristics

A total of 311(106 cases and 205 controls) of Diabetic Mellitus patients who follow in Jimma University medical centre were interviewed with response rate of 97.78%.

The mean age (±Standard deviation) for the cases and the controls were 59.08(SD: ±9.25) and 42.42(SD: ±13.95) respectively. Sixty nine (65%) of cases and 125(60.9%) of controls were male participants. From all of the participants, 55(52%) of cases and 116(56.6%) of controls were from rural and 51(48%) of cases and 89(43.4%) of controls were from urban residence. In addition, 75(70.7%) cases and 127(61.9%) of controls belongs to Oromo by ethnicity.

Regarding religion of respondents,67(63.2%) of cases and 101(49.3%) of controls were Muslims and39(36.8%) of cases and 104(50.7%) of controls were Christians. Concerning Educational status, 43(40.5%) of cases and 25(12.2%) of controls were lacks formal education (Illiterate) and 63(59.4%) of cases and 180(87.8%) of controls were Literate. From cases 29(27.4%) and 77(72.6%) were government employer and self and private business respectively, but from the control group 42(20.5%) and 163(79.5%) were government employer and self and private business respectively. Majority, 101(95.2%) of cases and 152(74.1%) of controls were in union.The median value of family's monthly income was 3061 ETB. Seventy six (71.7 %) of cases and 117(57.1%) of controls were below the mean value of the whole participants (see table2).

Concerning bivariate logistic regression, age of respondents, family income, educational level and marital status were potential candidate for multiple logistic regression (see table2).

Table 2. Socio demographic characteristics of diabetic patients who follow at Jimma University Medical Center, Ethiopia, 2018

Variable	Category	Cases (n=106)	Controls (n=205)	COR (95%CI)	P-Value
Age in years	<60 years	48(45.3%)	177(86.3%)	1	<0.001
	≥60 years	58(54.7%)	28(13.7%)	7.63(4.39,13.27)	
Residence	Urban	51(48%)	89(43.4%)	1	
	Rural	55(52%)	116(56.6%)	0.82 (0.51 ,1.32)	0.43
Education level	Illiterate	43(40.6%)	25(12.2%)	4.91(2.77 , 8.69)	<0.001
	Literate	63(59.4%)	180 (87.8%)	1	
Occupation	Government employee	29(27.4%)	42(20.5%)	1	
	Self and private business	77(72.6%)	163(79.5%)	0.68(0.39,1.18)	0.173
Family's Monthly Income (in cash)	<3061ETB	76(71.7%)	117(57.1%)	1.90(1.15,3.15)	0.012
	≥3061ETB	30(28.3%)	88(42.9%)	1	
Sex	Male	69(65%)	125(60.9%)	0.83(0.51,1.36)	0.477
	Female	37(35%)	80(39.1%)	1	
Marital status	In Union	101(95.2%)	152(74.1%)	7.04(2.72,18.22)	<0.001
	Not in Union	5(4.8%)	53(25.9%)	1	
Religion	Christians	39(36.8%)	104(50.7%)	1.76(1.09,2.86)	0.02
	Muslim	67(63 .2%)	101(49.3%)	1	
Ethnicity	Oromo	75(70.7%)	127(61.9%)	1	
	Amhara	22(20.8%)	42(20.5%)	0.88(0.49,1.59)	0.690
	Others	9(8.5%)	36(17.6%)	0.42(0.19,0.92	0.032

COR: Crude Odds Ratio, CI: Confidence Interval, 1: reference category

5.2 Behavioral characteristics

From study participants, fifty nine (55.6%) of cases and 130(63.4%) of controls were adhered to had regular exercise. Among study participants, 65(61.4%) of cases and 92(44.9%) of controls were not adhered to medication of diabetes. Concerning alcohol consumption history, 16(15%) of cases and 10(4.8%) controls were consumers. Five of participants from cases and two from controls had smoking history. Regarding meal adherence, 68(64.2%) of cases were not adhered but 129(62.9%) of controls were adhered to meal. From all study participants, 62(58.5%) of cases and 166(80.9%) of controls were adhered to blood glucose measurement at home (see table3).

In bivariate logistic regression, Adherence to exercise, alcohol consumption history, and adherence to medication, meal and glucose measurement were potential candidate for multiple logistic regression (see table3).

Table 3.Behavioral characteristics of diabetic patients who follow at Jimma University medical center, Ethiopia, 2018.

Variable	**Category**	**Cases (n=106)**	**Controls (n=205)**	**COR(95% CI)**	**P-Value**
Adherence to exercise	Yes	59(55.6%)	130(63.4%)	1	
	No	47(44.4%)	75(36.6%)	1.38 (0.85,2.22)	0.185
Alcoholic history	Yes	16(15%)	10(4.8%)	3.46(1.51,7.93)	0.003
	No	90(85%)	195(95.2%)	1	
Smoking history	Yes	5(4.7%)	2(0.9%)	5.02(0.95,26.35)	0.056
	No	101(95.3%)	203(99.1%)	1	
Adherence to medication	Yes	41(38.6%)	113(55.1%)	1	
	No	65(61.4%)	92(44.9%)	1.94(1.20,3.14)	0.006
Adherence to meal	Yes	38(35.8%)	129(62.9%)	1	
	No	68(64.2%)	76(37.1%)	3.03(1.86,4.94)	<0.001
Adherence to blood glucose measurement at home	Yes	62(58.5%)	166(80.9%)	1	
	No	44(41.5%)	39(19.1%)	3.02(1.79,5.08)	<0.001

COR: Crude Odds Ratio, CI: Confidence Interval, 1: reference category

5.3. Medical factors

Ninety nine (93.4%) of cases and 124(60.5%) of controls were type II diabetic patients. There were family history of Diabetic Mellitus in 56(52.8%) of cases and 64(31.2%) of controls. Concerning micro-vascular complications,51(48.1%) of cases and 20(9.7%) of controls had history or diagnosed as having other micro-vascular complications like heart and renal diseases. In this study,41(38.7%) of the cases and 19(9.3%) of controls had Systolic hypertension, whereas 49(46.3%) of cases and 47(23%) of controls had diastolic hypertension. The proportion of poor glycaemic control was 67(63.2%)in cases and 41(20%)in controls. From study participants, 54(56.2%) of cases and 51(27.1%) of controls also had poor serum cholesterol level.Thirty four (32.4%) of cases and 18(8.7%) of controls were anaemic and concerning the body mass index, from cases 30(28.3%) of them and from controls 59(28.8%) were overweight.

In bivariate logistic regression, Family history of Diabetes mellitus, duration of Diabetic mellitus after diagnosis, adherence to medication, having other micro-vascular complications, Systolic hypertension, diastolic hypertension, poor glycaemic control, poor serum cholesterol and low haemoglobin level were potential candidate for multiple logistic regression(see table4).

Table 4.Medical history of diabetic patients who follow at Jimma University medical center, Ethiopia, 2018.

Variable	Category	Cases (n=106)	Control (n=205)	COR(95% CI)	P-Value
Family history of Diabetic Mellitus	Yes	56(52.8%)	64(31.2%)	2.46(1.52,3.99)	<0.001
	No	50(47.2%)	141(68.8%)	1	
Duration of DM after diagnosis	<6years	36(33.9%)	142(69.2%)	1	
	≥6years	70(66.1%)	63(30.8%)	4.38(2.65,7.22)	<0.001
Other micro-vascular complications	Yes	51(48.1 %)	20(9.7%)	8.57(4.71,15.60)	<0.001
	No	55(51.9%)	185(90.3%)	1	
Systolic blood pressure	<140mmhg	65(61.3%)	186(90.7%)	1	
	≥140mmhg	41(38.7%)	19(9.3%)	6.17(3.34,11.39)	<0.001
Diastolic blood pressure	<90mmhg	57(53.7%)	158(77%)	1	
	≥90mmhg	49(46.3%)	47(23%)	2.89(1.75,4.77)	<0.001
Glycaemic level (RBS)	Good	39(36.8%)	164(80%)	1	
	Poor	67(63.2%)	41(20%)	6.87(4.07,11.58)	<0.001
Serum Cholesterol level	Good	54(56.2%)	51(27.1%)	1	
	Poor	42(43.8%)	137(72.9%)	0.29(0.17,0.48)	<0.001
Haemoglobin level	<11mg/dl	34(32.4%)	18(8.7%)	4.97(2.64,9.37)	<0.001
	≥11mg/ml	71(67.6%)	187(91.3%)	1	
BMI	<25 kg/m^2	76(71.7%)	146(71.2%)	1	
	≥25 kg/m^2	30(28.3%)	59(28.8%)	0.97(0.58,1.64)	0.929

COR: Crude Odds Ratio, CI: Confidence Interval, 1: reference category

5.4 .Determinants of Diabetic Retinopathy

In bivariate logistic regression analysis, age, educational status, income level, adherence to meal, adherence to exercise, adherence to medication, adherence to blood glucose measurement at home, alcohol consumption, family history of Diabetic Mellitus(DM), duration of Diabetes Mellitus, complications other than diabetic retinopathy(DR), systolic Blood Pressure, diastolic Blood Pressure, glycemic level, serum cholesterol level and hemoglobin satisfied the criteria and are a potential candidates for the multiple logistic analysis.

In multivariate logistic regression analysis, age ≥ 60 years, those lack formal educational level(illiterate), poor adherence to medication, family history of Diabetes Mellitus, presence of other micro vascular complication, poor glycemic control, systolic hypertension, poor cholesterol control and being anemic patients were significantly associated with the development of diabetic retinopathy.

Odds of developing Diabetic Retinopathy was almost five times higher in patients with age ≥60 years than patients under 60 years of age (AOR = 5.04: 95%CI; 1.83,13.87).

The study revealed that illiterate Diabetes Mellitus patients had about seven times higher odds of developing diabetic retinopathy than literates (AOR=7.17, 95%: CI 2.61, 19.70). Patients who were not adhered to medication were three times more likely in developing retinopathy than the adhered ones (AOR=3; 95%CI: 1.29, 6.95).

The study also revealed that odds of developing diabetic retinopathy was more than three times higher for patients with baseline Systolic Blood Pressure level of ≥140mmHg than their counters parts (AOR=3.38, 95%CI: 1.26, 9.05). Odds of developing diabetic retinopathy was nine times higher in patients with poor blood glucose control than those of in good blood glucose control (AOR: 9.08, 95%CI: 3.70, 22.29).

The study also revealed that participants who had family history of Diabetes Mellitus and those had other micro-vascular complications were around four times higher to develop diabetic retinopathy than their counter parts (AOR=3.95; 95%CI: 1.64, 9.54), (AOR=3.76; 95%CI: 1.33, 10.66) respectively.

In the study, patients with poor cholesterol control was about 79% less likely to develop diabetic retinopathy than those having good serum cholesterol control (AOR= 0.21, 95%CI: 0.08, 0.514). Concerning hemoglobin of study participants, anaemic patients were more than two and half

times had the probability of developing diabetic retinopathy than non-anaemic patients (AOR= 2.8, 95%CI: 1.05,7.47)(see table 5).

Table 5.Multivariate logistic regression analysis of Diabetic Retinopathy in Jimma University Medical Center, Ethiopia, 2018.

Variable	Category	Cases (n=106)	Control (n=205)	COR(95% CI)	AOR(95% CI)	P-Value
Age in years	<60 years	48(45.3%)	177(86.3%)	1	1	
	≥60 years	58(54.7%)	28(13.7%)	7.63(4.39,13.27)	5.04[1.83,13.87]	0.002
Education level	Illiterate	43(40.6%)	25(12.2%)	4.91(2.77,8.69)	7.17(2.61,19.70)	<0.001
	Literate	63(59.4%)	180 (87.8%)	1	1	
Adherence to medication	Yes	41(38.6%)	113(55.1%)	1	1	
	No	65(61.4%)	92(44.9%)	1.94(1.20,3.14)	3(1.29,6.95)	0.01
Family history of DM	Yes	56(52.8%)	64(31.2%)	2.46(1.52,3.99)	3.95(1.64,9.54)	0.002
	No	50(47.2%)	141(68.8%)	1	1	
Other micro-vascular complications	Yes	51(48.1 %)	20(9.7%)	8.57(4.71,15.60)	3.76(1.33,10.66)	0.013
	No	55(51.9%)	185(90.3%)	1	1	
Systolic blood pressure	<140mmhg	65(61.3%)	186(90.7%)	1	1	
	≥140mmhg	41(38.7%)	19(9.3%)	6.17(3.34,11.39)	3.38(1.26,9.05)	0.015
Glycaemic level (RBS)	Good	39(36.8%)	164(80%)	1	1	
	Poor	67(63.2%)	41(20%)	6.87(4.07,11.58)	9.08(3.70,22.29)	<0.001
Serum Cholesterol level	Good	54(56.2%)	51(27.1%)	1	1	
	Poor	42(43.8%)	137(72.9%)	0.29(0.17,0.48)	0.21(0.08,0.514)	0.001
Haemoglobin level	<11mg/dl	34(32.4%)	18(8.7%)	4.97(2.64,9.37)	2.8(1.05 ,7.47)	0.038
	≥11mg/ml	71(67.6%)	187(91.3%)	1	1	

COR: Crude Odds Ratio, AOR: Adjusted Odds Ratio, CI: Confidence Interval, 1: reference category

6. DISCUSSION

Study participants whose age was ≥60 years were five times more likely to have diabetic Retinopathy whencompared to patients age was <60 years. This finding had been confirmed by different literatures in different countries. A studies done in Arbaminch General hospital(23), in England(7),Armenia(41),in Oman(14),and another cohort study done in United States(20) stated that older age was strongly associated with occurrence of diabetic retinopathy. As being older age was a strong predictor for Diabetic Retinopathy, developing any retinopathy was higher in older age(36). The primary reason for this is that many elderly diabetic patients suffer from physical and mental ailments and often take poor control of their blood sugar, especially in consideration of their social background(49).

In this study, Diabetes patients of with no formal education had odds of developing diabetic retinopathy seven times higher than literate patients. This result has similarity with other literatures like the studies conducted in Saudi Arabia(50), Korea(25) and in Japan(26,27) suggests that less educated or who had no formal education had high probability of developing diabetic Retinopathy than attained higher classes and lack of proper educational attainment was significantly associated with progression of retinopathy. So, patients with no formal education have high probability of increasing diabetic complications like Diabetic retinopathy (37) and by giving proper health education and counselling on consequences of poor adherence to diabetic care, understand side effects, possibility of patients clinical outcomes were found to have improved significantly. Patients with inadequate literacy were less likely than patients with adequate literacy to achieve tight control of diabetic retinopathy (51)

The study also revealed that poor adherence to medication were three times more likely for developing retinopathy than in good adherence. This finding is consistent with studies done in rural India(38) and Gegharkunik province of Armenia(41) as poor adherence to medication had significant association with development of diabetic retinopathy, and in Sudan(33) those with poor adherence of taking Oral hypoglycemic agent was significantly associated to Diabetic Retinopathy.Even though, as diabetic patients were poorly adhered to their recommended medication, their blood sugar level increased and probability of developing diabetic retinopathy was more likely.

This study revealed that the odds of Diabetic Retinopathy were high on patients with family history of diabetes, which was about four times higher than those had no family history of Diabetic Mellitus. This is similar with studies conducted in Arbaminch General Hospital (24), in Jimma University medical centre(29) and in high risk Chinese population (32) stated that odds of Diabetic Retinopathy were high on patients with family history of diabetes than their counter parts.In addition this study also shared the findings of the different area mentioned above, those born from family history of diabetes mellitus (DM) was strong determinant factor for occurrence of diabetic retinopathy than without family history of Diabetic Mellitus patients due to genetic predisposing.

Poor glycemic control had highest probability of developing retinopathy than those with good glycemic control. This finding is similar with longitudinal study in Arbaminch General Hospital(23), Saudi Arabia(22), cohort study in China(36), and in Qatar(52)shown that odds of developing Diabetic Retinopathy was more likely in those had poor glycemic control than with good glycaemic level. So, poor glycemic control was found to be major determinants of retinopathy and hyperglycemia is thought to cause endothelial damage and the risk of developing retinopathy(34).

In this study poor cholesterol control was negatively associated to occurrence of diabetic retinopathy i.e. it was about 79% less likely than those had good cholesterol control. This finding is similar with the study done in Singapore, it was reported that higher cholesterol control were protective of any retinopathy(53). However, the studies done at Saudi Arabia(22),cohort Study done in China(36), and cohort study done by Malawi-Liverpool-Welcome Trust Clinical Research Programme(54) revealed that poor control of cholesterol increases the probability of Diabetic Retinopathy than those of in good blood glucose control. These discrepancy might be due to different sources of bias like observer and measurement bias which might be needed to conduct the research again on the study area.

In this study systolic hypertension was also one independent factor that determines the development of retinopathy in diabetic patients. This is similar with Cohort Study in China(36), Arbaminch(24) ,cohort study in Korea(37) and in rural India(38) the odds of developing Diabetic

Retinopathy was higher in Systolic Blood Pressure≥140mmhg than their counter parts. The presence of systolic hypertension increases the probability of developing diabetic retinopathyby making retinal hyper perfusion which is a key source of injury in diabetic retinopathy associated with shearing damage to capillaries. Also increased retinal blood flow is found with conditions that worsen diabetic retinopathy than normal systolic blood pressure.

This study revealed also presence of other micro vascular complication was another determinants of diabetic retinopathy. The finding is consistent with studies done in high-risk China population(32) revealed renal problem was one of the risk factors associated with Diabetic retinopathy and in India also suggests that renal complication was significantly contributed higher probability for Diabetic Retinopathy (39). So patients who had history or diagnosed as having any other micro vascular complication like diabetic nephropathy and cardiac diseases had higher probability of developing diabetic retinopathy(37). In our present study, patients with such complication should have to have more careful ophthalmologic follow-up.

The study also revealed that being anaemic had also contributed for the occurrence diabetic retinopathy i.e. those had haemoglobin of undercut of point were about three times more likely to have Diabetic Retinopathy than their counterparts. Similarly other studies done in Rumania(15) and in USA(51) stated thatthose have hemoglobin lower than cut off point was independently associated with an increased risk of Diabetic Retinopathy. But cohort study done in china(36), Korea(37) and Ethiopia done in Jimma(29) suggests that higher hemoglobin was independently associated with an increased risk of Diabetic Retinopathy. These study implies, anemia induced retinal hypoxia which alter angiogenesis, capillary permeability, vasomotor response, and cell survival and also due to low plasma ferritin concentration(39) which contributed for development of diabetic retinopathy. Those researchers who considered high hemoglobin leads to probability of Diabetic Retinopathy were by their implication of patients with poor glycemic control have high hemoglobin(plasma ferritin concentration)significantly predicted major micro vascular complications like Diabetic Retinopathy by damaging retinal blood vessels (29). The study in Korea (56)suggested that decreased hemoglobin may cause direct organ damage as a possible mechanism in that low hemoglobin, through a reduction in shear stress, fosters the development of DR. In small vessels, shear stress is important in regulating the synthesis of

nitric oxide and controlling vessel tone and angiogenesis. In the retina, shear stress may also influence the function and activity of the retinal micro vessels, acting on endothelial cells and pericytes, which are important regulators of vascular remodeling and tone.

The strength of the study were the cases and controls were taken from the same setting except the outcome difference, assessment of model fitness using by different measures and reliability test of the questionnaire.

The limitations were, Behavioral factors like adherence on diabetic care, Blood Pressure, Measured cholesterol and hemoglobin, were collected from current data which may not be exactly the same prior to development of diabetic retinopathy. Because of institutional-based nature of study issue of generalizability of finding for total population is difficult.

7. CONCLUSION

Diabetic retinopathy is one of the chronic complications of diabetes mellitus. This complication develops in diabetic patients through process. To develop retinopathy in diabetic patients there are many factors that determine the development. The findings in this study shown that older age of greater than 60 years, Diabetic Mellitus patients who lacks formal educational schooling, poorly adhered to anti Diabetic Mellitus medication, Being born from having family history of Diabetic Mellitus, presence of other micro vascular complication like renal problem and Heart diseases, poor blood glycemic control level, having systolic hypertension, poor serum cholesterol level and being anemic patients were significantly associated with the development of diabetic retinopathy.

8. RECOMMENDATION

The study recommends to the following concerned bodies specifically

Jimma University Medical Center:

- The Hospital should give attention by supplying necessary logistics, assigning trained health professionals and give necessary training for who lacks proper training for different health professionals who could treat diabetic patients.
- The Hospital should seek coordination with the Oromiya Regional Health bureau to prevent diabetic retinopathy and give necessary attention to factors that determines occurrences of diabetic retinopathy.

Health care professionals:-

- They should consider older age patients, and creating good awareness to have optimal adherence on medication especially for diabetic patients who lacks formal education.
- Counsel patients that they must control their blood sugar, blood Pressure control level and also keep above normal range of their hemoglobin.
- Early identification and prompt management of patients with other micro vascular complication.

Diabetic Patients

- Diabetic patients who follow chronic care in their diabetic clinic should strictly follow advice given from physicians.
- As much as possible they should be optimally adhered to their medication.
- Regularly check their blood glucose, blood pressure, and serum cholesterol and hemoglobin level.

Researchers:-

- Large-scale population-based longitudinal studies are needed to examine the natural history of the development and progression of Diabetic Retinopathy in study area.
- Further studies need like follow up studies to identify other independent risk factors related to development of diabetic retinopathy like behavioral factors should be identified from the beginning of follow up in diabetic clinic.

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ANNEX –I

JIMMA UNIVERSITY
FACULTY OF PUBLIC HEALTH DEPARTMENT OF EPEDEMIOLOGY
Data Collection Tools On Determinants of Diabetic Retinopathy at JUMC South west Ethiopia 2018.

I. **Information sheet**:

Good morning/afternoon [According to its convenience]. I am _____ who is the data collector for a research to be conducted by a Masters student from Jimma University, Faculty of Public health . Today, I am here to collect information on determinants of Diabetic Retinopathy in this hospital among patients on Diabetic follow up,where it is expected to identify determinants of Diabetic Retinopathy it would help for further mitigation of diabetic retinopathy, so I want to ask you some questions.

There is no immediate and direct benefit in terms of money that you will earn from this information; rather I hope, you might get moral satisfaction due to the information you give now, where it is a resource in contributing for the community welfare in general and for those diagnosed with Visual problem in particular.

If you take part in the study, it will not take us more than 30 minutes, your name will not be included in the information, I promise to keep the confidentiality of your reply. There is no risk that comes due to your involvement in the study. Your participation is completely voluntary and you have full right to withdraw at any time in the course of data collection even after you get involved without being subject to any intimidation and incrimination to you. Your choice either to involve or not will not compromise any services that you ought to get from this unit/hospital. However, I hope that you will participate in this study considering that single genuine information you provide will contribute a lot to the fulfillment of the objective of the study.

As a result, I request you sincerely to participate in the interview by providing authentic answers. Do you have any questions that you need to be clarified more?

If you have any question you can contact the principal investigator at any time convenient for you using the following address:

Name: Dugasa Garoma Banti
Address: Nekemte College of health sciences
Cell phone: +251-9178-673 82/0945658001
E-mail: dhgaroma@gmail.com

II. **Informed consent form**

Based on the understanding of the information I gave you, are you willing to participate in this study

a) Yes, I agreed to participate ☐ → proceed to interview

b) No, I don't agreed to participate ☐ → Thank the respondent and End the interview

Name of the interviewer_____
Signature of the interviewer _____
Date _____

Questionnaire number_____

Patients' medical card number_____

Result of interview: A) Completed B) Not completed C) Partially completed D) Refused

Checked by Supervisor:

Name _____Signature_____

Questionnaire

Annex 3: Questionnaire (English version)

Part one: socio economic /demographic conditions

s.no	Questions	Response	Skip
Q101	Age	----------years	
Q102	Sex	1.Male 2.Female	
Q103	Residence	1.urban 2.rural	
Q104	Marital status	1.Married 2.Single 3. Widowed 4. Divorced	
Q105	Educational level	1. cannot read and write 2. can read and write 3. Primary school (1-8) 4. secondary school 9-12 5. diploma 6. degree and above	
Q106	Occupation	1.student 2.merchant 3. farmer 4.government employee 5.self employed 6.house wife 7.others, specify------	
Q107	Religion	1.protestant 2.orthodox 3.catholic 4.muslim 5.others ,specify----------	
Q108	Ethnicity	1. Oromo 2.Amhara 3.Tigre 4.Gurage 5.Other(Specify)_____	
Q109	Income (in cash)	----------birr	

Part Two – Patient's Behavioral and life style factors related questions**(Patient-Interview)**

Q no	Question	response	skip
Q201	Do you have exercise plan you set with your doctor(like fast walking, dancing)?	1.yes 2.No	If no go to Qno 203
Q202	If yes to Q.no 201 How many days a week do you do some form of moderate exercise (like fast walking)?	----------days/week	
Q203	Have you consumed alcohol (within the last 12 months)?	1.yes 2.no	If no Skip to No.206
Q204	In the past 12 months, how frequently have you had at least one drink?	_____(daily/amounts per week or month)	
Q205	When you drink alcohol, on average, how many drinks do you have during one day?	Number ___ __ □ Don't know	
Q206.	Have you ever smoked?	1.yes 2.No	If no, go to Q209
Q207.	If yes, Do you smoke now?	1.yes 2.No	
Q208.	If yes Qn no. 207 , How many packets per day do you smoke when you smoke?	_____	
Q209	How many times a day, are you should to take medications to lower your blood sugar?	1. Once a day 2. twice a day 3. three times or more	
Q210	How many times a week you did not take your medication for blood sugar?	_____ (a number)	Enter "0 " for no
Q211	For Qno. 210 , Which one of the following was the reason for not taking your medication for blood sugar?	1.Cost of medication too expensive 2.Forgetfulness 3.Feeling well without medications 4. Complex regimen 5.Physicians mode of approach 6. Lack of trust on the efficacy of medications 7.othrs,specify(_____ __)	
Q212	Did you had meal plan?	1. Yes 2. no	If no skip to Qno.215
Q213.	If yes what type of meal plan have you decided to follow?	1.small frequent meals 2. five or more fruits and vegetables a day 3. counting carbohydrates	

		4. other (please specify) _____	
Q214	In the last week, how many days of the week did you follow your meal plan?	_____ (To follow it, you would have had to eat all 3 meals that day according to your chosen meal plan).	Enter "0 " for no
Q215	Do you have regular glucose measurement?	1.yes 2. no	
Q216	How many times a week do you check your blood sugar?	_____	Enter "0 " for no
Q217	Do you have Family history of diabetes?	1.Yes 2. No	

Part - three Patients data to be filled from patient chart and/or to be measured by the interviewer.

QNO.	QUESTIONS	RESPONSE	SKIP
Q301	Type of DM	type 1 2. type 2	
Q302	duration of diabetes after diagnosis	_____years/months(write in months if<1year).	
Q303	presence of diabetic retinopathy(DR)(from patient chart)	1.Yes 2. no	If no skip to Qn No.305
Q304	If yes to Qn 303 which type of DR	1. Proliferative DR 2. Non-proliferative DR	
Q305	Medication the patient was on(from patient chart)	1.oral hypoglycemic agent 2.insulin 3.oral hypoglycemic agents and insulin 4.not on any medication	
Q306	Specific medication the patient was on (from patient chart)	1. NPH insulin 2.Glibenclamide and metformin 3.Metformin 4.Glibenclamide 5. Metformin and NPH insulin	
Q307	presence of micro-vascular complications other than retinopathy that was on the patient card)	1. Yes 2. No	If no skip to no. 309
Q308	If yes to Qn no.307 encircle from options more than one is possible	1. Cardio-vascular 2. Renal disease 3. No ,any of the above complications	
Q309	Blood pressure (near to data collection)(measured by data collectors).	SBP_____mmHg DBP_____mmhg	

310	Fasting blood sugar (recent 3 measurements).	Reading 1_____mg/dl Reading 2_____ ___mg/dl Reading 3_____mg/dl Average _____mg/dl	
Q311	Hemoglobin (from card or if done on data collection time).	_____mg/dl	
Q312	Cholesterol level(from card or if done on data collection time)	_____mg/dl	
Q313	(Weight &Height measured by data collectors)	Weight _____kg Height _____cm,	

Thank you for giving me this all time for the interview.

FAAKALTII SAAYINSII UUMMATAA MUUMMEE IPIDIMIYOOLOOJII
Qorannoo '' Determinants of Diabetic Retinopathy '' Hospitaala Ispeeshaalistii Yuuniversitii Jimmaatti ,2018.

LATII

Yaada odeeffanoo

Akkam bulte/akkam oolte? Ani----------jedhama. odeeeffannoo tokko tokko akkan funaananuuf kolleejjii saayinsii fayyaa,yuuniversiitii Jimmaa tiin dhufe. kanaafuu har'a kanan assitti argame odeeffannoo dhukubaa sukkaaraa agartuu Ijaa miidhan waliiin walqabataniif kanneen rakkoon sukkaaraan walqabatee agartuun ijaa akka miidhamuuf shoora taphatan waliin qaban ilaalchiseeti.

Qarshii ati gaaffiif deebii kana irraa argattu homtu hin jiru garuu yaadaaf odeeffannoo ati amma naaf kennitu karooraaf namoota tarii rakkoo agartuu qabaniif immoo odeeffannoon ani si biraa argadhu akka galtee guddatti na fayyada.

Yoo gaaffiif deebii kanarratti hirmaatteef daqiiqaa 15 caalaa hin fixxu. Maqaan kees asirratti hin galmaahu,hirmaattees dhistees namni sidirqisiisu hin jiru. Hirmaachuuf dhiisuun mirgakeeti jechuukooti. Akkati hirmattuuf deebii dhugaaf gaha ta'e akka naaf laattu si affeereera.

Gaaffiif yaada ifaa siif hin taane yoo jiraate karaa teessoo kanaa nama barbaadde sana quunnamuu dandeessa.

Maqaa ; Dhugaasaa Gaaromaa Bantii
Tessoo ; kolleejjii saayinsii fayyaa Naqamtee
Bil; 0917867382/0945658001
Email; dhgaroma@gmail.com

Unka yaada waligalitee

Yaadaa amma ani siif kenneef hubannoo ati odeeffannoo sanarraa argatteen gaaffiif deebii irrratti hirmaachuu barbaaddaaree?

1. eeyyee ☐ ⟶ gaaffiif deebicha itti fufi

2. lakki ☐ ⟶ namicha galateefadhuutii gaaffiif deebicha goolabi.

Maqaa odeeffannoo funaanaa----------
Mallattoo odeeffannoo funaanaa----------
Guyyaa ----------
Lakkoofsa gaaffii(koodii)----------
Lakkoofsa meedikaala dhukubsatichaa----------

Bu'aa gaaffiif deebichaa

A)guutuu B)kan guutuu hin taane C) Gartokko duwwaa kan guutame. D) ni dide.

Supervaayizeraan kan mirkanaa'e

Maqaa ---------- mallattoo ----------

Gaaffileewwan(Questionnaires)
Kutaa tokko; gaaffilee hawaasummaa waliin wal qabate

lakk	Gaafilee	Deebbiiwwan (itti mari ykn iddoo duwwaatti barreessi)	Irra utaali
G101	Umuriin kee meeqa?	Waggaa_____	
G102	Saala	1.dhiira 2.dhalaa	
G103	Eessa jiraatta?	1.magaala 2.baadiyyaa	
G104	Haala fuudhaaf heerumaa	1.kan fuudhe/heerumte 2.kan hin fuunees hin heerumnes 3.kan wal hiikan 4.kan abbaan manaa/haati manaa du'e/duute	
G105	Sadarkaa barumsaa	1.dubbisuuf barreessuu hin dandahu/ssu 2. dubbisuuf barreessuu dandaha/ssi 3. daree (1-8) 4. daree 9-12 5. diploomaa 6. digirii fi isaa ol	
G106	hojiikee	1.barataa 2.daldalaa 3.qonnaan bulaa 4.hojjetaa mootummaa 5.hojii dhuunfaa 6.haadha warraa 7.kan biroo yoo jiraatee--------	
G107	Amantii kee	1.protestaantii 2.orthodoxii 3. kaatoolikii 4.muusliima 5.kan biroo yoo jiraatee----------	
G108	Saba/gosaa	1.oromoo 2.amaaraa 3.tigree 4.gurage 5.kan biraa----------	
G109	Galii ji'a (qarshiidhan)	Qr._____	

Kutaa lammaffaa: gaaffilee kununsa dhukubsattoonni ofiif godhu kan ilaallatu

lakk	gaaffiwwan	Deebbiwaan	Irra tarii
G 201	Ogeessa kee waliin kan waliigaltee sagantaa sochii qaamaa qabdaa (kan akka adeemsaa, Daansii?	1.eeyee 2.lakki	Yoo deebiin kee lakki ta'e gaaffii 203tti darbi.
G202	Yoo deebiin kee eeyee ta'e lakk 201 torbeetti guyyaa meeqa goota sochii qaamaa giddu galeessaa (kan akka daddafanii deemuu/suksukuu)?	Guyyaa_____ torbee keessatti	
G203	Waggaa kana keessatti alkoolii dhugdee beektaa(ji'a 12 as) ?	1.eeyee 2.lakki	Yoo lakki ta,e G206 deemi.
G204	Waggaa kana keessatti yoo xiqqaate-al-tokko illee hagam hagamiin dhugaatii alkoolii dhugda?	_____(guyyaadhaan/torbetti guyyaa hagana/ji'atti guyyaa hagana)	
G205	Yommuu alkoolii dhugdu aveereejjiidhaan guyyaatti hagam dhugda?	_____(baay'ina) Hin beeku_____	
G206	Tamboo xuuxxee beektaa?	1.eeyyee 2.lakki	Lakki taanaan G 209 deemi
G207	Deebiin kee eeyyee taanaan amma xuuxaa jirtaa?	1.eeyyee 2.lakki	
G208	Deebbiin kee eeyee yoo ta'e lakk.207 pakeettii meeqa guyyaatti xuuxxa?	_____	
G209	Guyyaatti qoricha sukkaara dhiiga kee keessaa gadi-buusu/hir'isu al meeqa fudhatta?	1. Guyyaatti al-tokko 2. Guyyaatti al-lama 3. Guyyaatti al sadii fi isaa ol	
G210	Torbeetti Qoricha sukkaara dhiiga keessaa gad-hir'isu al-meeqa otuu hin fudhatiin hafta?	_____(baay'ina guyyaa)	

G 211	**Deebii G210 irratti qorichicha akka ati hin fudhanne kan si taasise maali?**	**1. qaalinsa qorichaa** **2. hirraanfachuu** **3. qoricha dhaabuun nan fayya jedhee yaaduu koo** **4.qorichicha fudhachuun cimaadha** **5. ogeessi fayyaa sirriitti na hin simanne** **6. qorichichi na hinfayyisu** **7. kan biroo yoo jiraate ibsi____**	
G212	**Karoora sirna soorataa qabdaa?**	**1.Eeyee 2. lakki**	**Lakki yoo ta'e G215 Deemi**
G213	**Eeyyee yoo ta'e karoora sirna soorata isa kam nyaachuuf murteessiteetta?**	**1. Nyaata xiqqoo-xiqqoo amma amma fudhachuu** **2. Kuduraa fi muduraa shanii fi isaa ol guyyaatti nyaachuu** **3. Nyaata kaarbohadreetii madaaluun nyaachuu** **4. Kan biroo yoo jiraate ibsi_____**	
214	**Torbee darbe keessatti guyyaa meeqa karoora sirna soorata kee itti fayyadamte?**	**_____(yoo xiqqaate guyyaatti soorata al sadii nyaachuu qaba)**	**''0'' barreessi yoo hin jirre**
G215	**Safara giluukoosii dhiigaa yeroo yeroon ni lakkoofsifattaa?**	**1. eeyyee 2. lakki**	
G216	**Torbeetti al meeqa Safara giluukoosii dhiigaa lakkoofsifattaa?**	**_____**	**''0'' barreessi yoo hin jirre**
G217	Maatii keessaa namni dhibee sukkaaraa qabu jiraa?	**1. Eeyyee 2.lakki**	

Kutaa 3ffaa Ragaa dhukkubsataa Sukkaaraa galmee irraa fi safaramee fudhatamu isa raga funaanuun.

Lak G.	**Gaaffii**	**Deebbiiwwan**	**Bira tari(skip)**
G301	Ramaddii dhukkuba sukkaaraa	1. ramaddii- 1 (type-I DM) 2. Ramaddii- 2(Type-II DM)	
G302	turtii dhukkuba sukkaaraa erga dhukkubichi adda bahee	Waggaa/ji'a (ji'aan yoo waggaa gadi ta'e) _____	
G303	Rakkoo agartuu/retinaan miidhamee jiraa (DR present)?(kaardii dhukkubsataa irraa).	1.eeyee 2. lakki	Lakki taanaan G-Lakk.305 deemi
G304	Eeyee yoo ta'e G lakk 303 irratti gosa DR isa kami?	1. Proliferative DR kan ta'e 2. proliferative DR kan hin-taane	
G305	Gosa qorichaa dhukkubsataan kun fudhachaa jiru(kaardii dhukkubsataa irraa)	1. kan liqimsamu qofa (oral hypoglycemic agent) 2.insulinii 3. kan liqimsamu (oral hypoglycemic) fi insulinii 4. qoricha kamiyyuu hin fudhatu	
G306	Qoricha amma dhukkubsataan kun irra jiru(kaardii dhukkubsataa irraa)	1. NPHinsulinii qofa 2.Glibenclamide fi metforminii 3.Metforminii qofa 4.Glibenclamidii 5. Metformin fi NPH insulinii	
G307	Rakkoo fayyaa wal-xaxaa biro qabachuu rakkoo qaroo/Retiinaatiin ala kan kaardii dhukkubsataa irra jiru jiraa? (kaardii dhukkubsataa irraa)	1. eeyee 2. lakki	Lakki taanaan Lakk 309tti darbi

G308	Lakk.307 eeyee yoo ta'e, filannoowwan kanneen keessaa tokkotti mari	1.rakkoo onnee waliin wal-qabate 2.rakkoo kalee waliin walqabate 3. rakkoo armaan olii keessaa tokkoyyuu hin qabu	
G309	Safara dhiibbaa dhiigaa (near to data collection)(safaramee ogeessa raga funaanuun)	SBP_____mmHg DBP_____mmhg	
G310	Safara sukkaaraa dhiiga keessaa erga nyaata nyaatee/ttee booda (recent 3 measurements) (kaardii dhukkubsataa irraa)	Safara 1ffaa _____mg/dl Safara 2ffaa _____mg/dl Safara 3ffaa _____mg/dl Avareejjii _____mg/dl	
G311	Hemoglobinii (from card or if done on data collection time).	_____mg/dl	
G312	Hanga coomaa dhiiga keessaa(Cholesterol level) (from card or if done on data collection time).	_____mg/dl	
G313	Ulfaatina fi dheerina(Weight and Height) safaramee ogeessa ragaa funaanuun)	Ulfaatina(Weight) _____kg Dheerina(Height)_____m,	

Yeroo qabdurraa turtii nawaliin dabarsiteef galatoomi!!