



Serum Homocysteine Level Among Type-2 Diabetic Patients with and without Diabetic Retinopathy

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Abstract

The diabetic retinopathy is a neurovascular complication of diabetes mellitus and it is the leading cause of vision loss among working adults worldwide. Homocysteine is a sulfur containing amino acid derived from the methionine metabolism. Homocysteine is an emerging risk factor for cardiovascular and nondiabetic ocular vaso-occlusive diseases. Studies indicate that mild elevations of homocysteine in plasma are associated with an increased risk for occlusive vascular disease, thrombosis, and stroke. The purpose of this study was to evaluate the relationship between plasma total homocysteine concentration and diabetic retinopathy. A descriptive hospital based cross-sectional study was conducted at Mymensingh Medical college Hospital. Blood samples were collected from the study subjects to estimate serum homocysteine (Hcy), fasting blood sugar (FBS), and blood pressure were measured and data were compiled for analysis. Homocysteine level was found to be significantly higher in cases ($19.17 \pm 6.13 \mu\text{mol/L}$) with Diabetic retinopathy patients compared to controls ($11.75 \pm 4.43 \mu\text{mol/L}$) Hyperhomocysteinaemia is associated with diabetic retinopathy and may play a role as a risk factor for the development of diabetic retinopathy.

Keywords: *Hyperhomocysteinaemia; Serum Homocysteine; Diabetic*

INTRODUCTION

Diabetes is a disease that interferes with the body's ability to use and store sugar, which can cause many health problems. Too much sugar in the blood can cause damage throughout the body, including the eyes. Sometimes, diabetes affects the circulatory system of the retina. Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. Symptoms of high blood sugar include frequent urination, increased thirst, and increased hunger. If left untreated, diabetes can cause many complications. Acute complications include diabetic ketoacidosis and nonketotic hyperosmolar coma. Serious long-term complications include cardiovascular disease, stroke, chronic kidney failure, foot ulcers, and damage to the eyes. Diabetes is due to either the pancreas not producing enough insulin or the cells of the body not responding properly to the insulin produced. Diabetes is a disease that occurs when the body cannot produce enough insulin or cannot use insulin effectively.

Diabetes Mellitus (DM) has emerged as one of the most challenging public health problems in the 21st century. It currently affects over 366 million people worldwide and this figure is likely to double by 2030. The greatest burden of this condition is felt in low and middle-income countries, and these nations account for about 80% of all cases of diabetes. In sub-Saharan Africa alone, there are about 12 million people suffering from this condition and there are projections that this number will reach 18 million by 2030, making the region the one with the fastest growing rates of diabetes mellitus in the world. In the Gambia for

instance, the incidence of DM has been projected to increase by three-fold within this period; that is from 22,000 cases in 2012 to 61,000 by 2030.

This silent, but imminent, public health problem would impose substantial challenges on the healthcare systems as well as on the economy of most developing nations in the near future. This is because a significant proportion of individuals who suffer from the condition in these countries are within the reproductive age. These are the same individuals who are expected to drive the economic machinery in these nations so as to achieve the agreed millennium development goals. When the disease affects these individuals, and if not properly controlled, it may lead to lifelong complications, which are generally associated with increased morbidity and mortality. For instance, poorly controlled DM can cause damage to eyes (leading to blindness), kidneys (leading to renal failure), and nerves (leading to impotence and foot disorders/ possibly amputation) as well as increased risk of heart disease, stroke, and poor blood supply to the limbs. Most of these complications are not only irreversible, but there are also costly to manage as they generally require management in specialized centers with sophisticated infrastructure and equipment, well trained staff and potent medications, which are all scarce in Southern Asia (SA).

OBJECTIVES

Objectives are specifically stated aims that would be achieved by conducting the research empirically. Objectives come out of the stated problem in a systematic order and form. Generally, these are some short independent sentence indicating a plan of step by step advancement towards collection of information.

The objectives are stated bellow:

General objective

1. To estimate the prevalence of diabetic retinopathy among self-reported diabetic patient.

Specific objectives

1. To assess the grading of retinopathy.
2. To assess all diabetic subjects fundoscopically.

METHODOLOGY

In a broader sense of the term, methodology considers all techniques, strategies, approaches to be applied at every phases of conducting the research, especially, in collecting, processing and analyzing information. Methodological consideration also involves the reliability and validity of techniques and findings. Documentary analysis has used for the study. Data are facts, figures and other relevant materials, past and present, serving as the bases for study and analysis.

Study Design: It was a descriptive study. A cross-sectional study was a descriptive study in which exposure the present status is measured simultaneously in a given population. Conducted with diagnosed diabetes mellitus' was defined as having diabetes diagnosed by a physician.

Study Population: The patients were randomly selected and were requested to fill the questionnaires and for those who were unable to fill due to illiteracy or being visually impaired, the researcher filled the questionnaire on their behalf. Inclusion criterion was used where only patients who had diabetes mellitus involved.

Study Area: The study was carried out in National Institute of Ophthalmology & Hospital, Dhaka. This is because it's Bangladesh's national referral hospital and would give results which would be more or less a representation of the whole country.

Variables

A. Socio- demographic characteristics of the respondents

1. Age
2. Sex
3. Religion

4. Marital status
5. Occupation

B. About diabetic retinopathy of the respondents

1. Duration
2. Exercise.
3. Diet.
4. Drug Intake
5. Past Family history.
6. Vision of the Eyes.
7. Result of Eye Examination.

Sample Size Calculation: In this study, total sample size 1002 was collected by using simple random sampling method. Data were collected by using pre-designed and pre-tested questionnaire. Patients with age 20 years and above were included in this study from selected sampling area.

The Sample size for this study was determined by the following formula-

$$n = \frac{z^2 pq}{d^2} = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.05)^2} = 384$$

Here,

- n = The desired sample size.
 Z = The standard normal deviate, usually set at 1.96, which corresponds to 95% confidence level.
 P = Prevalence of outcome or the proportion of the target population estimated to have a particular characteristics. As the value was unknown, it was taken to be 50%.
 q = 1 – p = 1 -0.5 = 0.5
 d = Standard error, which was taken as 5%.

By the above calculation, the sample size was calculated as 384. Although during the procedure of data collection total 1002 respondents participated willingly and all of them were counted for the study. So, after data collection of data, the sample size was taken as 1002.

Sampling Technique: The screening procedures included history taking, visual acuity measurement, and retinal examination by fund us photography. Fund us photographs were taken in nine different positions of gaze through dilated pupils. Using the criteria recommended by the American Optometric Association the retinopathy was graded in severity. ‘Recently diagnosed diabetes mellitus’ was defined as having diabetes diagnosed by a physician.

Data Collection Sources: Data were collected from primary sources. The secondary data collection method has focused on extensive literature review covering relevant national-level studies and reports. Websites of relevant organizations were analytically surfed through. Besides, newspapers, conference proceedings, working papers, Journals, Articles, Term paper, Research Report, and other sources of information were also explored to the optimum level. All the data obtained from secondary sources were analyzed and eventually a conclusion is drawn resulting in incorporating our ideas and experiences.

Methods of Data Collection: Data were collected through interview method, i.e. Interviewers collect data from the respondents through face to face interview. After informed written consent was obtained from the patients, basic demographic data regarding age, gender, race, and occupation of the patients was recorded. Also the patients' medical records, duration of diabetes, type of medication were recorded.

Data Processing and Data Analysis: The data analysis stage was really an attempt to answer the relevant research questions by examining and assessing the collected information to identify patterns and meanings. The gathered data was interpreted and analyzed. After entire collecting data, it was computerized using suitable data entry software, such a SPSS; MS. Excel etc Data was analyzed by using SPSS software. Data

analysis was done by computer aided statistical Software SPSS version 22. Data were presented in the form tables and graphs. Data was analyzed with descriptive statistics, bivariate analysis. Frequency distributions for the variables were described with descriptive statistics. After the data had been collected, analyzed and interpreted, the final report was then written.

RESULTS AND DISCUSSION

The assessment of retinopathy was done by only one retinal specialist, using FFA images. DR was classified using a severity scale recommended by the International Council of Ophthalmology and American Academy of Ophthalmology.

Table 1: Distribution of the respondents by age

Age in years	With Diabetic Retinopathy (%)	Without Diabetic Retinopathy (%)
20 - 29 years	6.0	7.0
30 - 39 years	11.2	15.0
40 - 49 years	33.8	25.5
50 - 59 years	31.0	32.5
≥ 60 years	18.0	20.0
Total	100.0	100.0

Table shows that study was conducted in different age groups. The mean age of the respondent was (Mean) 3.64 years and (SD) 1.06 years, in the minimum age 25 years and maximum 50 years. The highest percentage of age group was 41 – 50 years and percentage was 33.8 % and lowest age group was ≤20 – 30 years and percentage was 0.9 % within 100%. The respondents were years of age followed by 41-50 years (33.8%), 51-60 years (31.9%), 61/70 years (16.7).

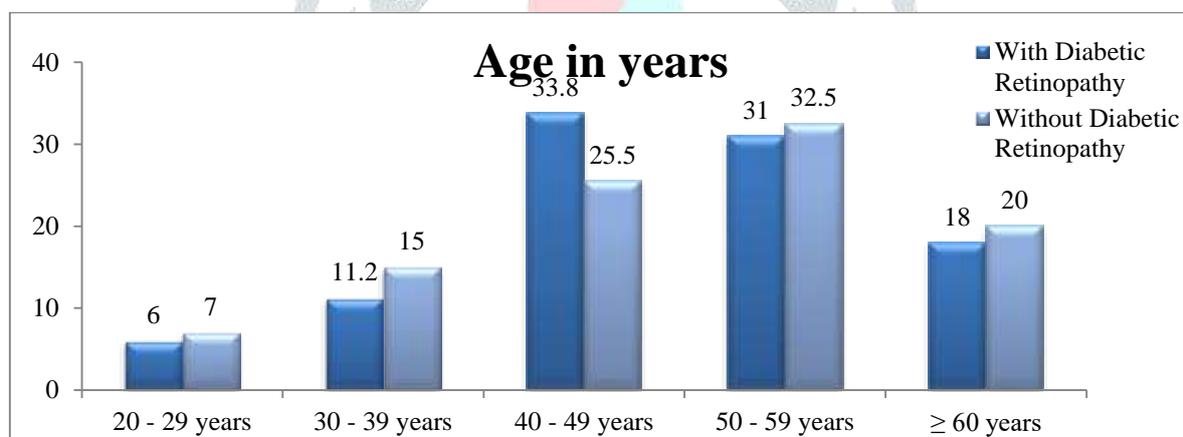


Figure 1: Distribution of the respondents by age

Graph shows that respondents different age groups. The highest percentage of age group was 41 – 50 years and percentage was 33.8 % and lowest age group was ≤20 – 30 years and percentage was 0.9 % within 100%.

Table 2: Distribution of the respondent's by Gender

Gender	With Diabetic Retinopathy (%)	Without Diabetic Retinopathy (%)
Male	73.5	76.0
Female	26.5	24.0
Total	100.0	100.0

Table shows that out of 1002 respondents, 766 (76.4%) were male and 236 (23.6%) were female. The mean gender of the respondent was (Mean) Mean 1.2355 and (SD) 0.42454 the Male and Female ratio was 23:77.

Table 3: Distribution of the respondents by Occupation

Occupation	With Diabetic Retinopathy (%)	Without Diabetic Retinopathy (%)
Service	462	46.1
Business	196	19.6
Home maker	201	20.1
Others	143	14.3
Total	100.0	100.0

Table shows that distribution of the respondents of the study by Occupation. Data shows that, 462 (46.1%) were Service, 196 (19.6%) were Business, 201 (20.1%) were Home maker, 143 (14.3%) were others categories.

Table 4: Distribution of the respondents by Duration of diabetes

Duration of diabetic	Frequency	Percentage (%)
≤ 1 – 5	423	42.2
6 – 10	270	26.9
11 – 15	152	15.2
16 – 20	76	7.6
≥ 20	81	8.1
Total	1002	100.0

Data shows that out of 1002 of the respondents, 270 (26.9%) were 6-10 years duration is (Maximum), and 76(7.6%) were 16 – 20 years duration is (Minimum), the mean duration of diabetes in years of the respondent was (Mean) 2.12 years (SD) 1.26 years.

Table 5: Distribution of the respondents by Maintain Exercise

Maintain Exercise	Frequency	Percentage (%)
Yes	727	72.6
No	275	27.4
Total	1002	100.0

The table shows that 727 (72.6%) maintained exercise and 275 (27.4%) didn't maintain exercise, out of 1002 of the respondent. That's maintained exercise Mean was 2.12 and SD 1.26.

Table 6: Distribution of the respondents by Maintain diabetic diet

Maintain diabetic diet	Frequency	Percentage (%)
Yes	819	81.7
No	183	18.3
Total	1002	100.0

The table shows that 819 (81.7%) maintained diabetic diet and 183 (18.3%) didn't maintain diabetic diet out of 1002 of respondents. Total respondents maintained diabetic diet Mean was - 1.1826 and SD - .38656.

Table 7: Distribution of the respondents by Types of drug intake

Types of drug intake	Frequency	Percentage (%)
No	541	54.0
Tablet	291	29.0
Insulin	108	10.8
Tablet + Insulin	62	6.2
Total	1002	100.0

Table shows that Distribution of the respondents by Types of drug intake. Out of 1002 of the respondents, 541 (54.0%) were don't taken any drug, 291 (29.0%) were taken Tablet, 108 (10.8%) were taken Insulin and the rest of were taken Tablet +Insulin 62(6.2%).

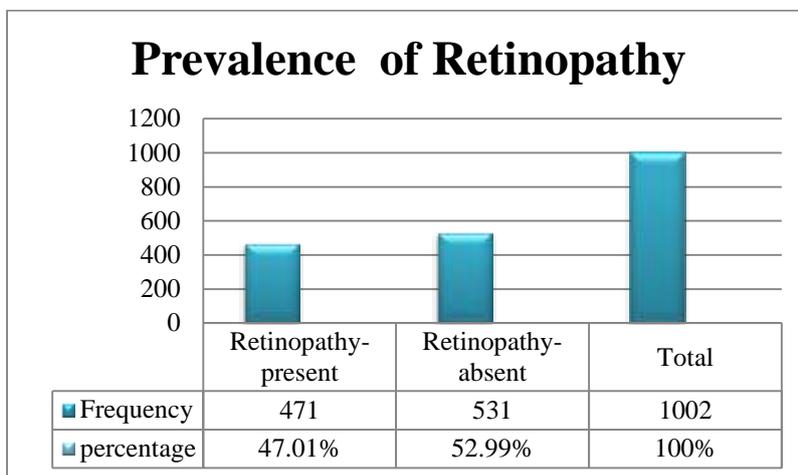


Figure 2: Prevalence of Retinopathy

The graph shows that retinopathy present was 471(47.01%) and retinopathy absent was 531 (52.99%) out of 1002 of respondents.

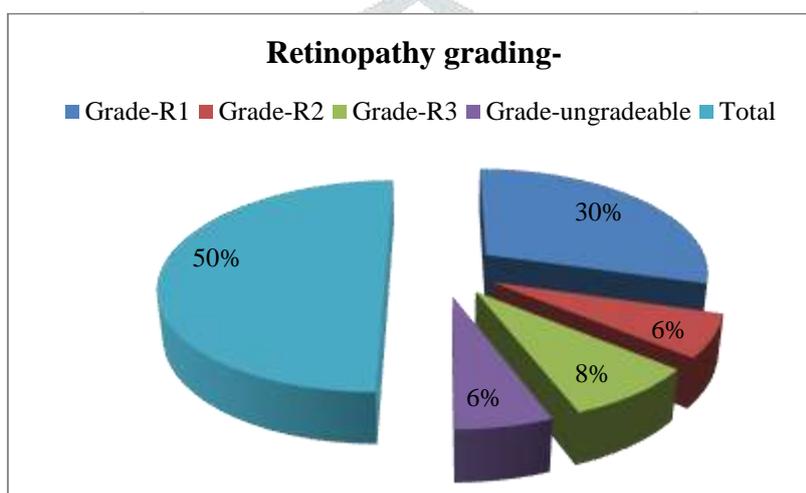


Figure 3: Retinopathy grading of respondents

The graph shows that retinopathy grading of respondent. Out of 50% respondents Grade R-1 was 30%, Grade R-2 was 6%, Grade R-3 was 8% and Grade – ungradeable was 6%.

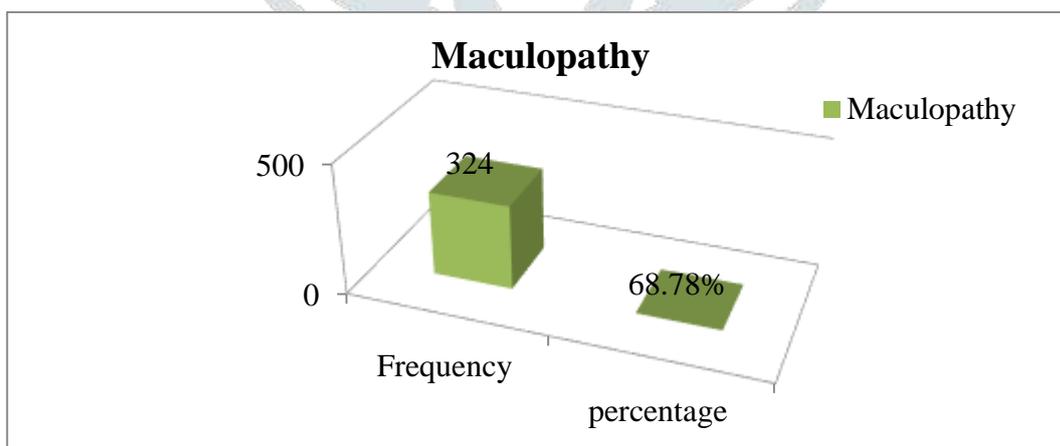


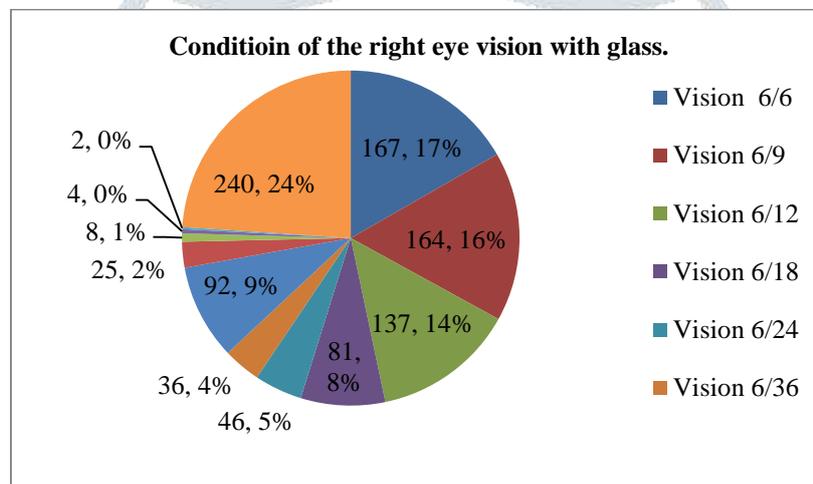
Figure 4: Prevalence of respondents Maculopathy

The graph shows that maculopathy present was 324(68.78%) out of 1002 of respondents.

Table 8: Distribution of the respondents by Conditions of the right eye Vision with glass

Condition of the right eye vision with glass		
Vision	Frequency	Percent
Vision 6/6	167	16.7
Vision 6/9	164	16.4
Vision 6/12	137	13.7
Vision 6/18	81	8.1
Vision 6/24	46	4.6
Vision 6/36	36	3.6
Vision 6/60	92	9.2
Vision CF	25	2.5
Vision HM	8	.8
Vision PL	4	.4
Vision NPL	2	.2
Vision Not applicable	240	24.0
Total	1002	100.0

The table shows that distribution of the respondents by conditions of the right eye vision with glass.

**Figure 5: Distribution of the respondents by Conditions of the right eye Vision with glass**

The figure shows that distribution of the respondents by conditions of the right eye vision with glass.

Table 9: Distribution of the respondents by previous family history

Previous family history	Frequency	Percentage (%)
Yes	521	52.0
No	481	48.0
Total	1002	100.0

The table shows Distribution of the respondents by previous family history. In total 1002 respondents 521 (52.7%) had heredity history and 481 (48.0%) hadn't heredity history.

Table 10: Distribution of the respondents by Present condition after Examination of the Rt. eye

Present condition after Examination of the Rt. eye	Frequency	Percentage (%)
RoMo	531	53.0
R1Mo	87	8.7
R1M1	191	19.1
R2Mo	4	0.4
R2M1	57	5.7
R3Mo	1	0.1
R3AM1	76	7.6
Un-gradeable	55	5.5

Total	1002	100.0
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Data shows that Distribution of the respondents by Present condition after Examination of the Rt eye. Out of 1002 of the respondents 531(53.0%) were RoMo, 87(8.7%) were R1Mo, 191(19.1%) were R1M1, 57(5.7%) were R2M1, 76(7.6%) were R3AM1 and 55(5.5%) were upgradeable.

Table 11: Distribution of the respondents by Present condition after Examination of the Lt. eye

Present condition after Examination of the Lt. eye.	Frequency	Percentage (%)
RoMo	507	50.6
R1Mo	99	9.9
R1M1	195	19.5
R2Mo	8	0.8
R2M1	57	5.7
R3Mo	1	0.1
R3AM1	74	7.4
Un-gradeable	61	6.1
Total	1002	100.0

Data shows that Distribution of the respondents by Present condition after Examination of the Lt eye. Table shows that out of 1002 of the respondents 507(50.6%) were RoMo, 99(9.9%) were R1Mo, 195(19.5%) were R1M1, 57(5.7%) were R2M1, 74(7.4%) were R3AM1 and 61(6.1%) were upgradeable.

CONCLUSION

Study reveals that there was a definite relationship between elevated serum HCY and diabetic neuropathy. Hyperhomocysteinemia may be a risk factor for retinopathy in patients of diabetes. There has been a significant increase of HCY in diabetic patients and its positive significant correlations with BMI, HbA1c, and duration of disease. Study found that elevated serum HCY level has led to some of the complications of diabetic neuropathy. Hence, conclude that there should be a regularized screening of serum HCY levels in all diabetes, to prevent complications of diabetic neuropathy.

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