

## Prevalence of Anaemia among Patients with Type 2 Diabetes Mellitus and its Prognostic Significance

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Conflict of interest: Nil

### Abstract

**Background:** Diabetes mellitus, commonly known as diabetes, is a metabolic disease that causes high blood sugar. The increasing prevalence of type 2 diabetes mellitus has become a major public health concern. Anemia in diabetic person has a significant adverse effect on quality of life and is associated with disease progression and the development of comorbidities

**Aim and Objective:** To know the prevalence of anemia among type 2 diabetes mellitus and its prognostic significance.

**Material and Method:** A prospective observational study was undertaken in which 70 cases of type 2 diabetes mellitus were studied for period of one year, in Department of General Medicine, Bhaskar Medical College and General Hospital, Yenkapally, after approval of ethical committee and followed exclusion and inclusion criteria

**Results:** Among all the patients, 30 (42.90%) of the patients were female and 40(57.10%) of the patients were male. 41(58.60%) of the patients were lying in the age group of 41 -60 years of age. Study observed prevalence of anemia was 80% among Type 2 diabetic patients. Cut off value to predict anaemia for HbA1C was 8.7 with sensitivity of 64.30% and specificity of 50%

**Conclusion:** Study conclude that the prevalence of anemia among adult diabetic mellitus patients is high. Therefore, anemia is a public health problem according to the finding of this research.

**Keywords:** Diabetes Mellitus, Anaemia, HbA1C.

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### Introduction

Diabetes mellitus, commonly known as diabetes, is a metabolic disease that causes high blood sugar. The hormone insulin moves sugar from the blood into cells to be stored or used for energy. With diabetes, body either doesn't make enough insulin or can't effectively use the insulin it does make. Epidemiological data showed that in 2016 there were 285

million people affected with the disease in the world, and it is estimated that in the year of 2030 we will have about 440 million diabetic patients.

The diabetes affects about 7% of the population worldwide. The prevalence of diabetes among adults in the southern states of India has been reported as being

18.6 % in urban populations and 10% in rural populations. [1,2] The prevalence rate is increasing in the younger age groups. [3, 4]The long term complications of diabetes is expected to occur during their productive years causing severe life burden in the form of economic and social burden. [5] The increasing prevalence of type 2 diabetes mellitus is emerging a major public health concern.

The increasing prevalence of type 2 diabetes mellitus has become a major public health concern. The diabetic patient number has been increasing due to population and urbanization growth, increase in the prevalence of obesity and sedentary lifestyle, and the longer survival of patients with DM [6].

Diabetes is a highly disabling disease, which can cause major complications in our body like loss of sight in the form of retinopathy, amputations of the fingers, renal disease, anemia, and cardiovascular and brain complications, among others, impairing the functional capacity and autonomy and day to day activities. Globally, anemia affects more than 1.62 billion people (24.8% of the global population) and it is responsible for 8.8% of the total disabilities globally.

Anemia has a significant negative impact on the overall global and national development [7]. Also anemia in diabetic person has a significant adverse effect on quality of life and is associated with disease progression and the development of comorbidities [8], like cardiovascular diseases, and increased morbidity and mortality. Now several studies suggest that anemia is twice as common in diabetics compared with non diabetics. [9] Despite these facts, anemia is unrecognized in 25% of the diabetic patients. [10]

Diabetic Patients who are anemic are prone to develop left ventricular hypertrophy which eventually leads to full-blown cardiovascular disease and chronic renal disease [11].

The etiology of anemia in diabetes is multifactorial. Anemia in diabetic patients may lead to the development and progression of micro- and macrovascular complications of diabetes, [12] which affects the quality of life and gives an additional burden on the health of the patients. [13], thus treatment of anemia among type 2 diabetes is very important to avoid such micro and macrovascular complication of diabetes.

So we have undertaken this study to know the prevalence prevalence of anemia among type 2 diabetes mellitus and its prognostic significance.

### **Material and Methods**

A prospective observational study was undertaken in which 70 cases of type 2 diabetes mellitus were studied for period of one year, in Department of General Medicine, Bhaskar Medical College and General Hospital, Yenkapally, Hyderabad after getting ethical approval from Institutional Ethical committee and following inclusion and exclusion criteria.

#### **Inclusion Criteria:**

- All patients above the age of 18 years.
- Both genders.
- Patients with type 2 diabetes mellitus.

#### **Exclusion Criteria:**

- Patients less than 18 years.
- Anaemia due to chronic blood loss and other secondary causes.
- Patients taking drugs for diseases like anticancer drugs, antiplatelet drugs causing anaemia.
- Diabetes mellitus patients with renal failure in the form of microalbuminuria, macroalbuminuria and kidney injury.

### **Methodology**

All the confirmed cases of type 2 diabetes were included in the study after all confirmation and approval. Anthropometric measurements like height and weight were measured using the

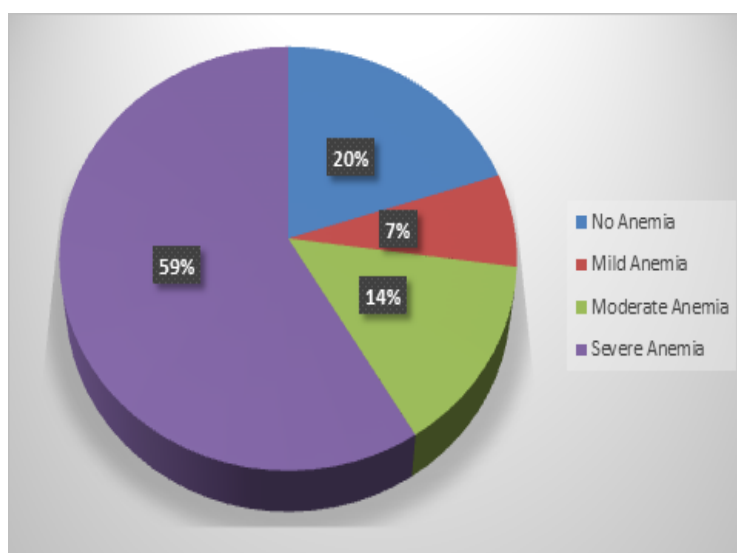
nearest centimetre without shoes and to the nearest 0.1kg respectively. Blood Pressure was measured using the sphygmomanometer from the upper arm after a patient sat for at least 5 minutes. A total of 5 ml venous blood was collected by an experienced laboratory technologist under a complete aseptic technique and from this, 2 ml venous blood was put into a test tube coated with EDTA anticoagulant for hemoglobin determination. The collected whole blood was properly mixed and put into an SYSMEX CBC machine for hemoglobin determination. The performance of the hematology analyzer was controlled by running quality control material alongside the study participant's sample. For creatinine determination, 3 ml of the venous blood was used by a test tube without any anticoagulant and the whole blood was allowed to clot for 20 minutes. The separated serum was put in to fully automated chemistry machine to determine creatinine. Also other parameter were taken with the help of customized questionnaire.

**Statistical Analysis:** All collected data

were entered in the Microsoft excel 2016 for further analysis, Qualitative data were presented with frequency and percentages as well as quantitative data were presented with mean and standard. Association between two variables were assed by chi-square test or fisher exact test. Mean difference of two independent variables assessed by t-test and ANOVA test. P-value less than 0.05 considered to statistically significant.

### Observation and Results:

In this prospective observational study total 70 patients were included in the study among them 30(42.90%) of the patients were female and 40(57.10%) of the patients were male. 41(58.60%) of the patients were lying in the age group of 41 - 60 years of age followed by 15(21.14%) in < 40 years and 14(20%) were lying in >60 years of age, minimum age of the patient was 29 years and maximum age was 82 years. Of the all patients we have observed that 80% of the patients were anaemic and 20% of the patients were non-anaemic also various distribution of anaemia shown in figure bellow.



**Figure 1: Distribution of anaemic patients among study population.**

Bellow table showed that there was statistically significant difference in BMI between anaemic and non anaemic patients.



**Figure 2: Distribution of gender and age among study population.**

**Table 1: Distribution of socio-demographic parameters in anaemia of study population.**

Parameters	Anaemia		Total	P-value
	No	Yes		
<b>Gender</b>				
Male	9(12.90%)	21(30%)	30(42.90%)	0.071
Female	5(7.10%)	35(50%)	40(57.10%)	
<b>Age</b>				
< 40 Years	2(2.90%)	13(18.60%)	15(21.40%)	0.65
41 - 60 Years	10(14.30%)	31(44.30%)	41(58.60%)	
> 60 Years	2(2.90%)	12(17.10%)	14(20.0%)	
Body Mass Index	28.3±2.4	30.2±4.2	29.1±3.5	<0.001

**Table 2: Distribution of other parameters in anaemia of study population.**

Parameters	Anaemia		Total	P-value
	No	Yes		
<b>Duration of Diabetes Mellitus</b>				
< 5 YEARS	2(2.90%)	7(10%)	9(12.90%)	0.918
5 - 10 YEARS	8(11.40%)	29(41.40%)	37(52.90%)	
>10 YEARS	4(5.70%)	20(28.60%)	24(34.30%)	
<b>HbA1C</b>				
7 % - 10%	11(15.70%)	35(50%)	46(65.70%)	0.325
> 10%	3(4.30%)	21(30.0%)	24(34.30%)	

Above Table showed that among all patients 41.40% of the patients had duration of diabetes between 5 -10 years followed by 28.60% had duration more than 10 years. We have also observed that among anaemic patients 62.5% of the patients had HbA1C level between 7%-10% and 37.5% of the patients were HbA1C level more than 10%

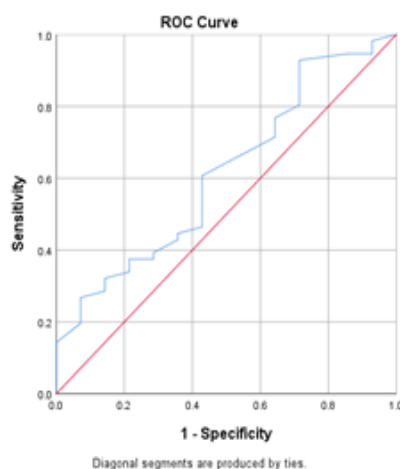
**Table 3: Mean distribution of various parameter among all patients.**

Parameters	Anaemia		P-value
	No	Yes	
Age	52.07±9.28	51.71±12.14	0.919
Haemoglobin	12.9±0.65	7.313±1.82	<0.001
HbA1C	6.3 ± 1.23	9.993 ± 2.12	< 0.001
Serum Urea	27.14 ± 5.15	31.25 ± 5.65	0.016
Serum Creatinine	0.843 ± 0.28	0.852 ± 0.17	0.88
DM Duration	8.71 ± 4.26	10.42 ± 3.21	<0.001

Mean difference of haemoglobin, HbA1C Serum urea and duration of diabetes mellitus was statistically significant between anaemic and non-anaemic.

**Table 4 : ROC curve to predict anaemia among diabetes mellitus.**

ROC Curve	Values
Area Under Curve	0.614
Std. Error	0.082
P-value	<0.001
95% CI	0.453 -0.891
Sensitivity	64.30%
Specificity	50%



Cut off value to predict anaemia for HbA1C was 8.7 with sensitivity of 64.30% and specificity of 50%

#### Discussion:

In this study 70 patients of diabetes mellitus were studied and the prevalence of anaemia and its prognostic significance are studied. Various parameters like complete hemogram, Renal function test were studied. Our study found altered renal function among the anaemic patients.

Among all 70 patients, 30 were male(42.90%) and 40 were female (57.10%). Among all diabetic females 87.5% females were anaemic. In this study, we compared the patients and their age distribution. It was found that in the age group of 41 -50 years , 58.60% of the patients had DM. Among 56 anaemic patients, 43% of the patients were from age group of more than 40 years of age. Travest et al [14] suggest that anemia is prevalent in elderly diabetics. similar

pattern was seen in our study where age group between 51-60 and 61-70 have higher incidence of anemia and quarter of them remain undiagnosed. Most of the patients belong to older age group with long duration of Diabetic mellitus that could be possible additional contribution factor for unexplained anemia. Polypharmacy is most common among diabetic patients which may contribute to anemia directly or indirectly. Our study showed that female were more predominant compared to males in anemia, other study conducted by S. Periasamy et al [15] observed female dominance in anemia. Similar study was conducted by Jéssica Barbieri et al observed female dominance in anemia. A study conducted by Nadia *et al.* found anemia in diabetic mellitus patients is comparatively higher in females (26%) than males (10%) [16]

Present study showed that, out of all the patients, 56(80%) of the patients were anemic, so in our study we have found the prevalence of anemia among type 2 diabetic patients was 80%. Among anemic patients 37.5% of the patients were male and 62.5% patients were female. study conducted by S. Periasamy et al[15] found that the incidence of anemia in diabetic mellitus was 38% in females and 36% in male. Similar study by Jéssica Barbieri et al observed prevalence of 65.75% among type 2 diabetes. In our study we have observed prevalence of anemia was more compared to other studies, it may because most of the population we have observed from rural population and had no awareness about nutrition and government scheme for iron deficiency among females. And also one of the reason we have observed was age group.

Maximum anemic patients had duration of diabetes as 5 -10 years followed by more than 10 years. Mean duration of diabetes mellitus was observed  $10.42 \pm 3.21$  years. S. Periasamy et al [15] observed mean duration of diabetes mellitus was 4 years while in study conducted by Nadia et al

found mean duration was 7 years. Marthias *et al* [17] found ACE inhibitors and ARB to be associated with reversible decrease in hemoglobin concentration in diabetics.

Our study observed that there was a higher prevalence of obesity and higher mean BMI and waist circumference in anemic patients when compared to nonanemic patients, however, there was a statistically significant difference between the groups. Anemia in diabetic patients is also related to obesity, BMI. The obesity or accumulation of circulating fatty acids is associated with the development of an inflammatory state that predisposes the development of insulin resistance. Insulin resistance reduces glucose tolerance especially in adipocytes and muscle cells, in which glucose uptake is insulin. This causes glucose accumulation in the circulation and consequently a hyperglycemic state [18]. It was observed in the present study that there are decreased values of hemoglobin, hematocrit, in anemic patients, which can be associated with a normocytic normochromic anemia characteristic of an anemia of chronic disease (ACD).

The gold standard for assessing glycemic control would be the achievement of HbA1c (glycated hemoglobin), which is one of the most important tools to assess glycemic control of patients with diabetes, as they express the average amount of glucose in the last three months, and this can infer the diabetes control efficiency and suggest the need for adjustments. Among anemic patients 62.5% of the patients had HbA1C level was between 7%-10% where 37.5% of the patients had level was more than 10%, On the basis of ROC curve we have observed cut off value for HbA1C to predict anemia was 8.7% with sensitivity of 64.30% and specificity of 50%. We didn't found any correlation between hemoglobin and serum creatinine and other lab parameters.

We have encountered with many limitation, we have not assessed any other

disease like CAD, Hypertension, also we have not studied whether patients were on any drugs of diabetes or not. Many studies found that prevalence of anemia was less compared to our study so further studies required to confirm the prevalence of anemia in same region.

### Conclusion :

Anaemia is one of the most common preventable conditions especially in diabetes mellitus. Patients with type 2 DM and anemia were more prone for comorbidities like hypertension, CAD etc. from all observation and results we can conclude that the need for periodic hematological screening in all diabetics presenting to hospital and adequate cost effective remedial measures in the form of supplementation of iron and vitamins will result in better outcome and prognosis and prevention of major complications. Also study conclude that the prevalence of anemia among adult diabetic mellitus patients is high. Therefore, anemia is a public health problem according to the finding of this research. However, it is not prioritized as one of the top problems among these patients in this study area before. The prevalence of anemia is higher among female diabetic mellitus patients in this study.

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### References :

1. Ramachandran A, Snehalatha C. Current scenario of diabetes in India. *J Diabetes*. 2009 Mar;1(1): 18-28.
2. Ramachandran A, Das AK, Josh SR, Yajnik CS, Shah S, Prasanna Kumar KM. Current status of diabetes in india and need for novel therapeutic agents. *JAPI*. 2010 June; 58(sup 3):7-9.
3. Ramachandran A, Snehalatha C, Kapur A, Vijay V, Mohan V, Das AK, Rao PV, Yajnik CS, Prasanna Kumar KM, Nair JD; Diabetes Epidemiology Study Group in India (DESI). High prevalence of diabetes and impaired glucose tolerance in India: National Urban Diabetes Survey. *Diabetologia*. 2001 Sep;44(9):1094-101.
4. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. Epidemiology of type 2 diabetes: Indian scenario. *Indian J Med Res*. 2007 Mar;125(3):217- 30.
5. Mohan V, Deepa R. Prevalence of diabetes and metabolic syndrome among Asians. *International Journal of Diabetes in Developing Countries*. 2010 Oct –Dec;30(4):173.
6. Brasil Minist'erio da Sa'ude, Diretrizes da Sociedade Brasileira de Diabetes 2013- 2014, AC Farmacêutica, 2014.
7. Durrani AM. Prevalence of Anemia in Adolescents: A Challenge to the Global Health. *Acta Sci Nutr Health*. 2018 Mar 23; 2(4).
8. Brasil Minist'erio da Sa'ude, Diretrizes da Sociedade Brasileira de Diabetes 2013- 2014, AC Farmacêutica, 2014.
9. Wright JA, Oddy MJ, Richards T. Presence and characterisation of anaemia in diabetic foot ulceration. *Anemia*. 2014;104214.
10. Abate A, Birhan W, Alemu A. Association of anemia and renal function test among diabetes mellitus patients attending Fenote Selam Hospital, West Gojam, Northwest Ethiopia: a cross sectional study. *BMC Hematol*. 2013 May 7;13(1):6.
11. Ritz E. Managing anaemia and diabetes: a future challenge for nephrologists. *Nephrol Dialysis Transplant*. 2005; vi21–vi25.
12. Thomas MC, Cooper ME, Rossing K, Parving HH. Anaemia in diabetes: Is there a rationale to TREAT? *Diabetologia*. 2006 Jun;49 (6): 1151-7.
13. New JP, Aung T, Baker PG, Yongsheng G, Pylypczuk R, Houghton J, Rudenski A, New RP, Hegarty J, Gibson JM, O'Donoghue DJ, Buchan IE. The high prevalence of unrecognized anaemia in patients with diabetes and chronic kidney disease: a population-based study. *Diabet Med*. 2008 May; 25 (5): 564-9.

14. Trevest K, Treadway H, Hawkins-van der Cingel G, Bailey C, Abdelhafiz AH. Prevalence and determinants of anemia in older people with diabetes attending an outpatient clinic: a cross-sectional audit. *Clin Diabetes*. 2014 Oct; 32 (4):158-62.
15. S. Periasamy, Adhin Antony Xavier, R. Gowtham. Incidence of anemia in type 2 diabetic mellitus and its prognostic index. *Int J Med Res Rev* 2016;4 (7):1239-1242.
16. Nadia Shams, M.H. Osmani. Newly Diagnosed Anemia in Admitted Diabetics, Frequency, Etiology and Associated Factors. *Journal of the College of Physicians and Surgeons Pakistan* 2015, Vol. 25 (4): 242-246.
17. Marathias KP, Agroyannis B, Mavromoustakos T, Matsoukas J, Vlahakos DV. Hematocrit-lowering effect following inactivation of renin-angiotensin system with angiotensin converting enzyme inhibitors and angiotensin receptor blockers. *Curr Top Med Chem*. 2004;4(4):483-6.
18. P. L. Hooper and P. L. Hooper, "Inflammation, heat shock proteins, and type 2 diabetes, *Cell Stress and Chaperones*, 2009;14(2):113–115.
19. Roy, D. S., Alqifari, D. S. F., & Walia, C. Cyclopedic analysis of medication-related osteonecrosis of the jaws in patients with diabetes mellitus. *Journal of Medical Research and Health Sciences*, 2022;5(8), 2153–2164.