



## CORRELATION OF TOTAL WHITE BLOOD COUNT AND MONOCYTES WITH GLYCATED HAEMOGLOBIN IN CASES OF TYPE II DIABETES MELLITUS.

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**ABSTRACT** Diabetes mellitus type 2 is a long-term metabolic disorder that is characterized by high blood sugar, insulin resistance, and relative lack of insulin. It is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. Several abnormalities have been defined in white blood cells (WBCs) in patients with diabetes mellitus, like abnormal WBC counts and altered metabolic properties. Other studies have noted abnormalities in monocyte counts and their function in diabetics. This study was undertaken to assess the total WBC count and monocyte count in patients with Type II diabetes mellitus (T2DM) and correlate with glycated haemoglobin (HbA1C) values which are a measure of glycemic control in these patients. The hemogram reports and HbA1C reports of 145 patients with T2DM over a one year period were perused and the findings were recorded and analyzed.

**KEYWORDS :** Type 2 Diabetes Mellitus, White Blood Cell Count, Monocyte Count, Glucated Hemoglobin

### INTRODUCTION

Type 2 Diabetes mellitus (T2DM) is a long-term metabolic disorder that is characterized by high blood sugar, insulin resistance, and a relative lack of insulin. The magnitude of this non communicable disease can be discerned from the fact that, in 2018 there were more than 500 million cases of type 2 diabetics worldwide<sup>1</sup>. In India, diabetes mellitus is fast gaining the status of a potential epidemic. An extensive population based cross sectional study done in 28 states of India (ICMR-INDIAB) has reported a prevalence of about 7.3% in 15 states of India<sup>11</sup>. A lower proportion of the population is affected in the states of northern India (Chandigarh 0.12 million, Jharkhand 0.96 million) as compared to Maharashtra (9.2 million) and Tamil Nadu (4.8 million)<sup>7</sup>. In Chennai, the prevalence of newly diagnosed diabetes has been reported to be as high as 20%<sup>3</sup>.

Several hematologic abnormalities have been described in patients with T2DM. One of the commonest, is the presence of anemia<sup>4</sup>. Abnormalities in white blood cells (WBC) have also been reported especially leukocytosis and more specifically neutrophilia, eosinophilia and lymphocytosis<sup>4,5</sup>. A raised WBC count has been associated with a higher risk of T2DM<sup>6</sup>. The total number of circulating monocytes in diabetic patients has been reported to be lower than that of healthy individuals<sup>6</sup>. In this study the relationship between glycemic control in the form of HbA1C (glycated haemoglobin) and abnormalities in total WBC count and monocyte count is explored.

### MATERIALS AND METHODS

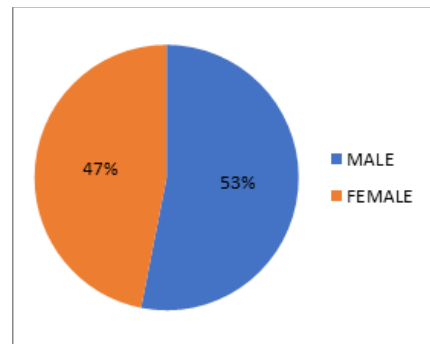
This was a retrospective study done on 145 cases of diabetes mellitus who had attended the hospital of a tertiary care centre. Complete enumerative sampling was done. The haematology and biochemistry records of cases diagnosed as diabetes mellitus, over a period of one year, from November 2017 to October 2018, were perused. Details regarding the values of HbA1C, total WBC count, monocyte percentage and absolute monocyte count in the study population were tabulated. The values of HbA1C was interpreted as follows: <6.5 - normal, ≥6.5 - diabetic<sup>7</sup>. The normal WBC count range was taken as 4.0-10.0x10<sup>9</sup>/l, normal monocyte percentage as 2-10% and absolute monocyte count as 0.2-1.0x10<sup>9</sup>/l.

The HbA1c values were correlated with gender and above hematological parameters.

Correlation and t test were done and analysis was done using SPSS Version 17. The results were noted.

### RESULTS

There were a total of 145 cases of Type 2 diabetes mellitus during the study period. Out of these 77(53%) were males and 68(47%) were female patients(Fig1). The age of the study subjects ranged from 23 to 69(Table:1).



**Figure 1:Gender wise distribution of cases.**

**Table 1: Age wise distribution of cases.**

Age	Number of cases	%
20-30	32	22
31-40	50	34
41-50	34	24
51-60	20	14
61-70	9	6

For the 145 cases of T2DM, the mean values of HbA1C, total WBC count, absolute monocyte count and monocyte percentage (%) were as follows(Table 2):

**Table 2: Mean values of HbA1C, total WBC count, absolute monocyte count and monocyte%.**

Haematological parameters	Mean
HbA1C	12.5538
Total WBC count	10831.38
Absolute monocyte count	462.059
Monocyte%	4.485

The mean values of the hematological parameters studied, in males are given in Table 3.

**Table 3: Mean values in males.**

Haematological parameters	Mean
HbA1C	12.2922
Total WBC count	11030.13
Absolute monocyte count	477.138
Monocyte%	4.679

The mean values of the hematological parameters studied, in females are given in table 4.

**Table 4: Mean values in females.**

Haematological parameters	Mean
HbA1C	12.8500
Total WBC count	10606.32
Absolute monocyte count	444.984
Monocyte%	4.265

The mean values of the total WBC count, absolute count and monocyte percentage were matched with the various HbA1C values to detect any positive correlation. (Table 5)

**Table 5: Correlation of mean values of total WBC count, absolute count and monocyte percentage with HbA1C**

HbA1C	Total number	Male	Female	Mean total WBC count	Mean absolute monocyte count	Mean monocyte %
6.5-7.0	8	7	1	7612.5	417.54	4.4
7.1-8.0	7	3	4	13585.7	625.64	5.3
8.1-9.0	5	1	4	8740	412.18	3.3
9.1-10.0	6	4	2	13533.33	470.06	4.76
10.1-11.0	4	4	NIL	10350	486.27	5.85
11.1-12.0	28	15	13	9332.85	439.23	4.33
12.1-13.0	24	14	10	12191.66	480.76	4.6
13.1-14.0	21	10	11	12214.28	475.3	4.14
14.1-15.0	16	8	8	11464.37	473.06	4.29
15.1-16.0	11	6	5	9836.36	409.01	5.18
16.1-17.0	9	2	7	9922.22	452.5	4.63
17.1-18.0	2	NIL	2	8800	440	3.15
18.1-19.0	1	NIL	1	NIL	NIL	NIL
19.1-20.0	1	1	NIL	NIL	NIL	NIL
20.1-21.0	2	2	NIL	6000	399.9	6.25

## DISCUSSION

Studies have reported variations in hematological parameters to be induced by hyperglycemia. Glycated hemoglobin levels give an indication of the glycemic control over a period of three months and correlation of this parameter with various hematological indices have been reported<sup>5,9,10</sup>.

In general the total WBC count and monocyte percentage have been reported to be higher in diabetics than non diabetics<sup>4</sup>. Other studies have shown the presence of leukocytosis in patients with higher values of glycated hemoglobin. It is believed that in diabetes mellitus higher WBC counts are present due to a generally activated pattern of the adaptive immune system<sup>5</sup>. Hyperglycemia was the most striking parameter modulating the pattern of immune cells. Moreover chronic inflammation as indicated by high total WBC counts is said to be frequently associated with micro vascular complications in diabetes mellitus<sup>7</sup>.

The total number of cases in this study was 145 and the number of males and females were almost equal. The mean values of total WBC count, absolute monocyte count, monocyte percentage and HbA1C were almost similar in both males and females. The total WBC count, absolute monocyte count and monocyte percentage were than correlated with increasing HbA1C values. However it was found that the values differed greatly in the various HbA1C groups and did not show any obvious correlation with increasing HbA1C values.

## CONCLUSION

Haematological parameters vary greatly in patients with diabetes mellitus and several studies have reported variations in the values with increasing hyperglycemia. It has been the norm to have the complete hemogram done for all cases of diabetes mellitus as they provide important clues to the presence of complications and comorbidities. Large scale population studies with a greater number of patients would definitely shed more light on this problem.

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