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Research Article

FREQUENCY OF ANEMIA IN TYPE 2 DIABETES MELLITUS PATIENTS

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Abstract:

Background: Anemia is a common blood disorder that is defined by World Health Organization (WHO) as hemoglobin less than normal amounts. Anemia is a common accompaniment of diabetes. HbA1c is included in diagnostic criteria of diabetes mellitus. Diabetes can drop of the protein hemoglobin levels, Type 2 diabetes mellitus is a common metabolic disease that is increasing on daily basis. It gets worse over time leading several shot and long term complications.

Objective: To determine the frequency of anemia in type 2 diabetes mellitus subjects.

Study design: Cross-sectional study.

Sample size: 424 male and female subjects known case diabetes mellitus.

Place: PMCH Nawabshah.

Duration: Jan 2016- Dec 2018.

Inclusion criteria: all male female age 20-70 years subjects admitted in PMCH Nawabshah. **Methodology:** The study was carried out among the healthy control subjects and in diabetic subjects to evaluate of the elements of absolute RBC, WBC and platelets count as a risk factor for diabetes among the discrete male and female population of Nawabshah and associated areas in Pakistan. The non-diabetics served as controls for the study. Statistical data was obtained for the data.

Results: anemia; decrease RBCs count and Decreased Hb levels were common finding in patients suffering from diabetes mellitus. **Keywords:** Anemia; Type 2 Diabetes Mellitus (T2DM); Complete Blood Count (CBC); HbA1C

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INTRODUCTION:

Anemia is the mainly significant community wellbeing trouble in children, females of all age groups. There is about 02 billions of world population affected due to anemia as reported by World Health Organization [1]. Generally iron deficiency affects all age groups of females resulting in delayed growth and the impaired cognitive development [2]. There are many factors responsible for the development of anemia it may result from dietary deficiency, infectious and other diseases, geographic distribution, hygienic conditions, low academic profile. [3] [4]. There is broad outcome of effects because of anemia, starting from poor growth milestone, decrease mental activity, affecting daily activities of life in different age groups. [5]. In African children and females anemia is one important reason of morbidity and mortality in severe cases. [6]. Diet, mal-absorption, bone marrow suppression may lead to iron deficiency commonly in different age and gender groups. The daily iron requirements of body varies at different levels like age group, sexually, racial groups and in pregnant and lactating females. Identification of various factors producing hindrances and causing increased requirements for daily iron requirements is an essential step in the management of iron deficiency. From the beginning days of Pakistan anemia is there in our population markedly present in different eras and different age and gender groups. Nutritional deficiency was blamed as main cause of anemia in those days in 1977 it was 38%. [7]. in 1988 a survey report in Pakistani children on nutrition declared that about 65% were anemic. [8]. Anemia due to iron deficiency or other reasons effect child growth physically and mentally in different developmental stages [9]. Studies had shown that in Pakistan 65%, 70% and 78% of children of age group 07- 60 months were suffering from iron deficiency anemia. [10].

The whole world is affected by anemia especially children and females of different age groups and marital status. About 750 millions of population is suffering from iron deficiency anemia in developed countries of the world as reported by researchers. [11]. It was concluded from different studies from different regions of the globe that many factors are responsible for anemia in diabetic patients. It is a common finding in diabetes [12-13-14]

Anemia is common in diabetic subjects due to its related complications it is one of the strong contributing factors leading to morbidity and mortality, [15, 16, 17].

The study aims to assess the frequency of anemia in subjects with type 2 diabetes mellitus and to evaluate

of the elements of absolute RBC and hemoglobin levels as a risk factor for diabetes among discrete male and female population of Nawabshah and associated areas in Pakistan.

METHODOLOGY:

This cross section study with total of 424 all male female age 20-70 years subjects admitted in PMCH Nawabshah, was carried out at Nawabshah from 2016 to 2018 with type 2 DM. The total enrolled population was screened for diabetes based on WHO diagnostic criteria for diabetes (The FBS value of more than 126 mg/ dl and PPBS value of more than 200 mg/dl). Those with normal sugars and with no family history of diabetes served as controls. Subjects with other infectious diseases were excluded. The subjects enrolled were either self-motivated or prescribed by the doctor for the screening of diabetes.

Data collection & Laboratory analysis methods:

After permission of hospital ethical committee and taking informed written consent from patients and their next of kin data was collected on written proforma and the study was carried out among the healthy subjects and in diabetic subjects. The nondiabetics served as controls for the study. Statistical data was obtained for the data.

Fasting blood samples and Postprandial blood samples were collected from subjects between 20 - 70 years from district Shaheed Benazirabad Sindh Pakistan. The samples were collected in both EDTA [18] in accordance to the protocol. Information related to age, sex, life style and history was collected from the subjects prior to collection of Blood sample. Blood samples were collected from the vein on the opposite side of elbow. The blood samples were investigated for biochemical data on complete blood count i.e. for absolute count of RBC and Hb along with the FBS and PPBS.

The Blood sugar levels (FBS, PPBS) were estimated to screen diabetics from the population. This was done by glucose oxidase and peroxidase [19] (GOD-POD) method and were analyzed using Star 21 plus autoanalyzer

Total count of RBC was done for absolute cell count. The blood diluted in ammonium oxalate was added to the hemo-cytometer chamber. The blood diluted with Hayem's solution is added to counting chamber of the Neubauer slide. Hemoglobin estimation was done by cyanmethemoglobin method for both cases and controls.

Statistical analysis

Data collected was assessed for fasting blood sugar and post prandial blood sugar and that of total RBC count and hemoglobin levels in form of mean \pm standard deviation of total count of RBC is given in millions. The units of measurement of Hb are in grams. The values were compared to the normal range.

Results

Total 424 male and female subjects were studied. Mean age of subjects with SD was 57.6509±6.31864 years, and age ranged between 45 and 75 years.

The mean and SD for FBS count was 132.3420+ 0.61 million/cumm, Hb% 10.67+1.89 g/dl, RBC count was 4.26+0.61 million/cumm, Hb% 10.67+1.89 g/dl, HCT 33.26+5.39, MCV 77.40+10.50, MCH 25.21+3.62, MCHC 32.52+1.89, WBCs count was 8143.01+2310.1 and mean platelet counts were 275.07+94.64. Different hematological variables were compared. Mean age, hemoglobin level, haemotocrit, MCHC, RBC count, WBC, and platelet count with $p = \langle 0.001 \rangle$ which was statistically significant. Table 1

Total 424 male and female subjects were studied 276 (65.1%) were males and 148(34.9%) were females. Most of study subjects had no occupation currently in 143(33.7%), 148 (34.9%) were house wives, 89(21.0% were manual workers and 44(10.4%) were office workers. A large number 400 (94.3%) of subjects were married and 24 (5.7%) were unmarried. A large portion of study population 324 (76.4%) from the rural setup and 100 (23.6%) were from city areas. Regarding educational status 13.2%, participants were illiterate at all levels while 86.8% were educated from primary to graduate levels. 272(64.2%) were from lower class, 120(28.3%) middle class and 32(7.5%) upper class. BMI was in normal range in 248(58.5%). over weight in 165(36.8%) and obese in 20(4.7%) patients. Regarding addiction 300(70.8%) have no addiction, 116(27.4%) were cigarette smokers and 08(1.9%) were alcoholics. Positive family history of diabetes was present in 164(38.7%) and negative in 260(61.3%) of patients. **Table 2.**

Regarding the diabetic statistics for drugs compliance and duration of diabetes, 19.8% patients were not using any kind of drug for diabetes but they claim diet and exercise are sufficient for the control. 10.45 were using insulin and 69.8% were on oral hypoglycemic drugs. Compliance assessment was at satisfactory level in 40.6% while unsatisfactory in 59.4% patients. Known duration of DM was less than 5 years in 57.5% patients, 34% in 5-10 years and 8.5% in more than 10 years. **FIG: 1**

Paired sample statistics and paired sample correlations were checked among HB pairs with other variable of CBC in terms of mean standard deviations, standard error of mean, correlations and significance levels as shown and detailed in table 3 in detail. Correlations and significance of Hb pairs with CBC variables. Haemotocrit, MVC, MCH, MCHC and hemoglobin levels were significantly associated with HB levels.(p=<0.000). While HB and RBC count (p=.012) and Hb and HBA1c were 0.681 that were not clinically significant. **Table 3.**

Paired sample test was checked among HB pairs with other variable of CBC and sugar levels in terms of mean standard deviations, standard error of mean, 95% confidence level with upper and lower limits and significance levels was p=<0.000 as shown in **table 4** with detail.

Pearson's Correlations with sig. (2-tailed) had shown that the correlation of CBC and sugar levels significant. Among HbA1c with Hb level p=0.000, HbA1c with compliance of drugs p=0.007, Hb level with duration of DM, compliance of drugs, p=0.000, drugs for DM with compliance p=0.000, FBS with RBS p=0.000 as clearly shown in table **Table 5**.

Table 1. Descriptive Statistics & Test Statistics Non-Parametric Test									
	Desc	Test Statistics Non-Parametric Test							
Variable	Minimum	Maximum	Mean	Std. Deviation	Chi-Square	df	Asymp. Sig.		
Age In Years	45.00	75.00	57.6509	6.31864	756.377	16	.000		
FBS	85.00	230.00	132.3420	33.00481	138.217	57	.000		
RBS	76.00	410.00	265.6769	73.29784	486.736	93	.000		
Rbc Count	1.40	6.00	4.2512	.59897	269.283	23	.000		
НСТ	10.4	46.6	33.263	5.3899	253.958	68	.000		
MCV	50.1	96.4	77.767	10.5721	299.302	84	.000		
МСН	16.9	36.1	25.309	3.5995	271.222	72	.000		
МСНС	26.0	37.0	32.613	1.8945	492.075	50	.000		
WBC	1300.0	20000.0	8291.415	2729.9930	220.858	89	.000		
Platelets	55	667	258.32	89.495	234.033	146	.000		
HBA1c Level	3.90	12.40	7.0894	2.44206	205.873	36	.000		
Hemoglobin	3.30	15.30	12.2189	2.13263	148.830	32	.000		

Variable	Sub variable	Frequency	Percent
Sex	Male	276	65.1
	Female	148	34.9
Accupation	No Occupation	140	33.7
Occupation	House Wife	143	33.7
	Manual Worker	140	34.7
		89	21.0
	Office Worker	44	10.4
Marital Status	Married	400	94.3
	Un-Married	24	5.7
Address	Rural	324	76.4
	Urban	100	23.6
Education	Educated	368	86.8
	Un-Educated	56	13.2
Socio Economical Class	Lower Class	272	64.2
	Middle Class	120	28.3
	Upper Class	32	7.5
Body Mass Index	Normal	248	58.5
	Over Weight	156	36.8
	Obese	20	4.7
Addiction	No Addiction	300	70.8
	Cigarette Smoking	116	27.4
	Alcoholism	8	1.9
Family History	Positive	164	38.7
	Negative	260	61.3
	Total	424	100.0



TABLE 3. Paired Samples Statistics and Paired Correlations. N=424										
		Std.	Std. Error	Correlation	Sig.					
	Mean	Deviation	Mean							
Hb level	10.817	1.8949	.0920	.122	.012					
RBC Count	4.2512	.59897	.02909							
Hb level	10.817	1.8949	.0920	.264	.000					
НСТ	33.263	5.3899	.2618							
Hb level	10.817	1.8949	.0920	.231	.000					
MCV	77.767	10.5721	.5134							
Hb level	10.817	1.8949	.0920	.259	.000					
МСН	25.309	3.5995	.1748							
Hb level	10.817	1.8949	.0920	.144	.003					
MCHC	32.613	1.8945	.0920							
Hb level	10.817	1.8949	.0920	.020	.681					
Hb A1c level	7.0894	2.44206	.11860							

TABLE 4. Paired Samples Test. N=424										
]								
				95% Confidence Interval of the Difference						
		Std.	Std. Error					Sig.		
	Mean	Deviation	Mean	Lower	Upper	t	df	(2-tailed)		
Hb level - RBC Count	6.56627	1.91638	.09307	6.38334	6.74921	70.554	423	.000		
Hb level - HCT	-22.4460	5.2199	.2535	-22.9443	-21.9477	-88.545	423	.000		
Hb level - MCV	-66.9498	10.3012	.5003	-67.9331	-65.9664	-133.827	423	.000		
Hb level - MVH	-14.4920	3.6066	.1752	-14.8363	-14.1477	-82.739	423	.000		
Hb level - MCHC	-21.7958	2.4792	.1204	-22.0324	-21.5591	-181.028	423	.000		
Hb level - Hb A1c level	3.72807	3.06095	.14865	3.43588	4.02026	25.079	423	.000		

Table 5. Pearson's Correlations with sig. (2-tailed)									
		HbA1c Level	Hb level	Duration Of Diabetes	Drugs For Diabetes	Compliance For Drugs	FBS	RBS	
Hb A1c Level	Pearson Correlation	1	.231**	131**	.052	093	.034	.123*	
	Sig. (2-tailed)		.000	.007	.285	.055	.481	.011	
Hb	Pearson Correlation	.231**	1	198**	.026	172**	047	031	
	Sig. (2-tailed)	.000		.000	.587	.000	.330	.522	
Duration Of Diabetes	Pearson Correlation	131**	198**	1	.018	.086	049	043	
	Sig. (2-tailed)	.007	.000		.710	.076	.313	.377	
Drugs For Diabetes	Pearson Correlation	.052	.026	.018	1	657**	.112*	.028	
	Sig. (2-tailed)	.285	.587	.710		.000	.021	.568	
Compliance For Drugs	Pearson Correlation	093	172**	.086	657**	1	109*	057	
	Sig. (2-tailed)	.055	.000	.076	.000		.025	.244	
FBS	Pearson Correlation	.034	047	049	.112*	109*	1	.550**	
	Sig. (2-tailed)	.481	.330	.313	.021	.025		.000	
RBS	Pearson Correlation	.123*	031	043	.028	057	.550**	1	
	Sig. (2-tailed)	.011	.522	.377	.568	.244	.000		
**. Correlation is significant at the 0.01 level (2-tailed).									
*. Correlation is signifi	cant at the 0.05 lev	el (2-tailed	1).						

DISCUSSION:

Anemia is an important common finding that is characterized by deficiency of iron, an essential mineral content. Haemoglobin is a protein that is rich in iron that carries oxygen to the whole body from lungs by means of RBCs. The sample of blood is tested to measure the level of Haemoglobin in the blood resulting in anemia. Oxygen carrying capacity of the hemoglobin is also decreased by increased blood sugar levels. The World Health Organization (WHO) Sexspecific definition of anemia defines female subjects as anemic those with < 12 g/dl and male subjects as anemic those with Hb < 13 g/dl [20].

The inability of the cells to utilize the available glucose due to resistance shown to a hormone called insulin secreted by the β -cells of pancreas. Imbalance between the insulin sensitivity and the insulin secretion result in hyperglycemic condition known as T2DM. No single factor is responsible for this chronic disorder. There are several predisposing factors. The study showed that there is prevalence of anemia in the population studied. This can be the blood sugar levels were found to be high in both male and female patients as per the WHO diagnostic criteria for diabetes. Attributed to the low values of total RBC count. Anemia contributes to tiredness in 74% of the diabetic people than those without anemia. An increase in the values of total WBC count was also observed in the T2DM cases when compared to the control values but within the normal range.

The findings of current research are matchable to different studies available.

There are about 69.2 million who are bearing the burden of diabetes. It increases overall burden of family members. Its incidence and prevalence is increasing day by day and is estimated to reach 529 million by 2035 (International Diabetes Federation). [21,22]

Earlier the disease was predominantly related to only in affluent elderly people. It is now affecting the children and adults equally that to irrespective of socioeconomic status. Peculiar characters of Indians make them more susceptibility to diabetes [23,24].

The occurrence of chronic illness diabetes mellitus type 2 is high in almost every part of the world. It is characterized by hyperglycemia due to underutilization glucose due to insulin resistance [25,26]. This leads a number of complications as it affects not only glucose metabolism but also disturbs the functioning of eyes, kidneys, heart and feet. Various markers [27-28-29] can predispose the future outcome of diabetes. The complications related to diabetes are risk factors for each other and also diabetes.

CONCLUSION:

Anemia and diabetes are common in same patients, multiple factors may be involved. Anemia and diabetes both are stressful conditions. From the above we can conclude that the diabetes population is having low Hb and absolute counts of RBC are the important markers for diabetes. The low RBC count accounts for the anemia in diabetic cases.

Future Directions: Further, this study can be continued on large sample size and also including other risk factors which influence the RBC count and Hemoglobin levels.

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Contribution of Authors:

Hajria Naila Rahu, AAJ and GMJ designed this research and supervised all the steps from collection of data to analysis (data gathering, scrutiny, explanation and in writing of the document). Other authors contributed actively in this research for data gathering. Masood Nabi Noor supervised study. All authors had read and approved the manuscript.

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