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Frequency of Anemia Amongst Patients with Diabetes Mellitus and Healthy Population

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Abstract

Background: Diabetes mellitus (DM), particularly type 2 diabetes (T2DM), is a growing global health concern, with over 537 million adults affected worldwide as of 2021. T2DM is associated with a range of complications, including cardiovascular disease, nephropathy, and neuropathy. An often overlooked but significant complication is **anemia**, which can worsen outcomes in diabetic patients. Anemia in T2DM is multifactorial—commonly linked to chronic inflammation, reduced erythropoietin production due to diabetic nephropathy, and nutritional deficiencies. Pro inflammatory cytokines like IL-6 and TNF-α play a central role by suppressing erythropoiesis and increasing hepcidin levels, which impairs iron metabolism. Anemia is common in diabetic patients and is linked to higher cardiovascular risk, faster kidney disease progression, lower quality of life, and increased mortality. Despite its impact, it often goes undiagnosed, especially in low-resource settings. This study aims to assess the frequency of anemia in diabetics versus healthy individuals and emphasize the need for routine anemia screening in diabetes care.

Methods: A comparative cross-sectional study was conducted at a community care center (Sehar Medical Center Karachi. Data were collected from 150 participants, both diabetic patients and healthy individuals. Hemoglobin (Hb) levels were used to identify anemia, and self-structured questionnaire were used to assessed knowledge, anemia status, life style and diabetes mellitus stouts.

Result: High prevalence of diabetes and anemia was observed, with 63.6% and 41.6% mean affirmative responses, respectively. Significant associations were found between disease duration and complications in diabetes ($p < 0.01$), and between hemoglobin testing and anemia diagnosis ($p < 0.001$). Lifestyle factors like diet and sleep significantly predicted better hemoglobin levels.

Conclusion: The findings highlight the burden of chronic conditions and underscore the importance of regular screening, symptom monitoring, and lifestyle interventions. Strengthening education and early detection efforts is essential for improving health outcomes.

Keywords: Diabetes Mellitus, Anemia, Prevalence, Risk Factors, Public Health

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder marked by persistent hyperglycemia due to defects in insulin secretion, insulin action, or both. As of 2021, over 537 million adults globally were affected by diabetes, with this number projected to rise to 783 million by 2045 (International Diabetes Federation) (Aschner et al., 2021). Among the various complications associated with DM, anemia has

gained recognition as a common and underdiagnosed condition that significantly worsens patient outcomes (Kamerman, 2022).

Anemia is defined as a reduction in red blood cell count or hemoglobin concentration, which limits the blood's capacity to transport oxygen effectively (Addo et al., 2021). In diabetic populations, particularly those with type 2 diabetes mellitus (T2DM), anemia is not merely a coincidental finding but a complication that arises from multifactorial mechanisms (Hizomi Arani et al., 2023). These include chronic inflammation, reduced erythropoietin production due to diabetic nephropathy, increased hepcidin activity impairing iron metabolism, and nutrient deficiencies associated with poor dietary intake or gastrointestinal side effects of medications like metformin (Mezil & Abed, 2021).

Recent studies demonstrate that anemia in diabetic patients leads to exacerbation of existing complications such as nephropathy, retinopathy, and cardiovascular disease (Obeagu & Obeagu, 2025). It also contributes to decreased exercise tolerance, fatigue, cognitive decline, and overall diminished quality of life (Bosman et al., 2001). The clinical significance of identifying anemia in DM lies in its prognostic implications, anemia not only reflects ongoing metabolic and vascular damage but may also accelerate the progression of comorbidities (Shah et al., 2021).

Despite its impact, routine screening for anemia in diabetic care remains limited, especially in low-resource settings. In this context, the present study aims to explore the prevalence of anemia among diabetic patients in comparison with a healthy population, identify associated risk factors, and emphasize the importance of integrating anemia screening in diabetes management protocols.

Literature Review

Recent studies have increasingly highlighted the burden of anemia in patients with type 2 diabetes mellitus (T2DM), showing that anemia is not only common in this group but also contributes significantly to the progression of diabetic complications, including nephropathy, cardiovascular disease, and reduced quality of life.

A 2023 systematic review and meta-analysis by (Arkew et al., 2023) analyzed data from 24 studies including 19,118 participants with T2DM. The pooled prevalence of anemia was **27.0%,** with slightly higher rates observed in African (28%) and Asian populations (26%). Factors significantly associated with anemia included **advanced age, female sex, longer duration of diabetes, poor glycemic control,** and **presence of diabetic nephropathy**. The study emphasized the urgent need for integrated anemia screening in diabetes management programs, especially in resource-limited settings.

Similar study conducted by (Ghamri et al., 2024) , Out of the 1,208 diabetic patients assessed, 53.4% were female and 42.1% were classified as obese. A notable 62.3% had poorly controlled diabetes. Additionally, 26.2% of the patients showed low mean corpuscular volume (MCV), while 96.8% had decreased mean corpuscular hemoglobin (MCH). Regarding iron status, 46.5% had normal serum ferritin levels, and 48.6% had normal serum iron levels. Most patients had normal thyroid function, 84.9% had normal free T4 levels, 71.8% had normal T3 levels, and 82.4% had normal serum TSH levels. The average hemoglobin level was 10.24 ± 2.36 g/dL. Based on hemoglobin classification, 86.6% (1,046 patients) were anemic of these, 30.2% had mild anemia, 47.6% had moderate anemia, and 22.2% suffered from severe anemia.

Another study conducted in Bangladesh by (Talukder et al., 2024) result showed that type 2 diabetes (T2D) was more common in urban areas, affecting 10.8% of the population, compared to 7.4% in rural regions. Pre-diabetes was also more widespread in cities (31.4%) than in the countryside (27%). One of the strongest predictors of diabetes in both settings was age, especially among people aged 55 to 64, who were nearly twice as likely to have T2D. Interestingly, people with higher levels of education were less likely to develop diabetes, while those who were wealthier or overweight faced a greater risk regardless of where they lived.

In rural areas, drinking caffeinated beverages and not participating in physically demanding jobs were linked to a higher chance of developing T2D—patterns that weren't significant among urban dwellers. Additionally, a clear connection was found between high blood pressure and diabetes among those living in urban environments.

A study conducted in Pakistan by (Uddin et al., 2025) focused on adolescents with type 1 diabetes (T1D), examining their age and body measurements in relation to anemia. Among the 169 participants, 81 were found to be anemic, while 88 were not. The results showed a significant difference in body measurements between the anemic and non-anemic groups. Blood tests revealed that those with anemia had significantly lower hematological values, with p-values indicating strong statistical significance ($p = 0.000$). Of the anemic patients, 47 were diagnosed with iron deficiency anemia, characterized by low iron and ferritin levels, and elevated total iron-binding capacity (TIBC). Overall, the study found a notable prevalence of anemia among adolescents with T1D. In addition to poorer blood profiles, anemic patients also had higher HbA1c levels compared to their non-anemic counterparts, indicating poorer glycemic control.

The study included 277 patients, with 121 males (43.7%) and 156 females (56.3%). When categorized by age, 6% were young adults, 58.5% were middle-aged, and 35.4% were older adults. The average hemoglobin level among participants was 11.1 g/dL. Anemia was found in 222 patients, accounting for 80% of the total. Among the males, 74% (90 out of 121) were anemic, while the prevalence was even higher in females at 84% (132 out of 156). Moderate anemia was the most common type (48%), followed closely by mild anemia (46%). Mild anemia appeared more frequently in males, whereas moderate anemia was more common among females (Chen et al., 2023).

Interestingly, the highest rate of anemia (88%) was seen in the younger age group (Sun et al., 2021). Across all age groups, mild to moderate anemia was far more common than severe forms. The condition was also strongly associated with other health factors—81% of patients with both hypertension and diabetes were anemic, and 78% of smokers were anemic as well (Köseoğlu & Özlek, 2024). Furthermore, the longer a person had been living with diabetes, the more likely they were to develop anemia.

Together, these recent findings confirm that anemia is a frequent and clinically significant condition in diabetic populations worldwide. The evidence points to a strong association between anemia and diabetic complications, poor glycemic control, renal impairment, and female sex. These insights reinforce the importance of incorporating regular anemia screening into diabetes management, particularly in low- and middle-income countries where the dual burden of diabetes and anemia is often underestimated.

Although anemia is a recognized complication of type 2 diabetes mellitus (T2DM), key research gaps persist, particularly in community-based settings of developing countries like Pakistan. Most existing studies are hospital-based, limiting the applicability of findings to the general population, especially those with undiagnosed or mild anemia.

Comparative studies between diabetic and non-diabetic individuals in similar settings are scarce, making it difficult to isolate the specific contribution of diabetes to anemia risk. Furthermore, patient awareness and health-seeking behaviors remain under-investigated, despite their influence on early diagnosis and prevention.

Many previous studies also lack detailed classification of anemia by type and severity, and fail to explore associations with knowledge, diet, and socioeconomic status—factors essential for designing effective community health strategies.

This study aims to address these gaps by comparing the prevalence of anemia between diabetic and non-diabetic individuals in a community setting, assessing participants' knowledge of diabetes, identifying associated demographic and clinical risk factors, and generating locally relevant data to inform future screening, prevention, and education strategies.

Theoretical frame work

This study is guided by Dorothea Orem's Self-Care Deficit Nursing Theory, which emphasizes the role of self-care in maintaining health and preventing complications. In the context of diabetes mellitus, patients often experience self-care deficits due to chronic illness, impaired kidney function, and poor nutritional management, which may contribute to a higher frequency of anemia compared to healthy individuals.

Orem's theory supports the idea that when individuals are unable to meet their therapeutic self-care demands such as managing diet, hydration, and symptoms and nursing interventions become essential. By applying this framework, the study aims to explore the differences in anemia prevalence between diabetic and non-diabetic populations, while highlighting the nurse's role in assessing needs, providing education, and promoting effective self-care practices to prevent anemia in clinical as well as in community health care settings.

Methodology

Study Design and Setting

This was a **cross-sectional, community-based comparative study** conducted at a private community care center/clinic. The study was designed to assess and compare the frequency of anemia among individuals with type 1 & 2 diabetes mellitus and a healthy control group.

Study Population

The target population included adult males and females aged 18 years and above. Two groups were enrolled:

Group A (Diabetic Group): Patients previously diagnosed with T2DM, based on fasting blood glucose ≥126 mg/dL or HbA1c ≥6.5%.

Group B (Healthy Group): Adults without diabetes, confirmed by fasting blood glucose <100 mg/dL and no history of diabetes or related medication.

Inclusion Criteria:

Adults aged ≥18 years

For diabetics: Confirmed diagnosis of T2DM for at least 6 months

For healthy controls: No diagnosis or symptoms of diabetes

Willingness to provide informed consent

Exclusion Criteria:

Patients with diagnosed hematologic disorders (e.g., thalassemia, leukemia)

Pregnant women

Patients undergoing chemotherapy or dialysis

Individuals with recent major surgery, active infection, or acute illness

Sample Size and Sampling Technique

A total of **150 participants** were recruited using **convenience sampling**, with approximately equal numbers in both diabetic and healthy groups (n = 57 diabetic; n = 75 healthy). The sample size was determined based on the feasibility of data collection within the study period and the need for comparative analysis.

Data Collection Tools and Procedure

The questionnaire was validated through expert review and a pilot test on 10% of the target population. Expert feedback ensured content clarity and relevance, while pilot testing assessed feasibility. Cronbach's alpha was calculated at 0.78, indicating acceptable internal consistency. Minor revisions were made based on the results.

Operational Definitions

Anemia: Defined according to WHO criteria—hemoglobin (Hb) <13 g/dL in men and <12 g/dL in women.

Healthy Population: Individuals without diagnosed chronic diseases, including diabetes.

Frequency/Prevalence: The proportion of individuals in a population with anemia at a given time.

Diabetes Mellitus (T2DM): Diagnosed based on fasting blood glucose ≥126 mg/dL or HbA1c ≥6.5%, or ongoing anti-diabetic treatment.

Data Analysis

Data were analyzed using **SPSS version 22.0**. Descriptive statistics (frequencies, means, standard deviations) were calculated. The **Chi-square test** was used to assess associations between categorical variables (e.g., anemia and diabetes status). A **p-value <0.05** was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee of Baqai Medical University. Written informed consent was obtained from all participants. All data were entered and confidentiality was maintained throughout the study.

Result

Descriptive analysis showed that 41.1% of participants had been diagnosed with diabetes, with 76% on medication, 78% having the condition for over five years, and 72% monitoring blood sugar regularly. The mean affirmative response for diabetes-related items was **63.62%**. A Chi-square test revealed a significant association between longer diabetes duration and complications ($\chi^2 = 18.42$, $p < 0.01$).

For anemia, 35% had ever been diagnosed, and only 20% within the past six months. However, 82% received treatment, and 70% were prescribed iron supplements. The mean affirmative response was **41.64%.** Chi-square analysis showed a significant association between recent hemoglobin testing and recent anemia diagnosis ($\chi^2 = 21.05$, $p < 0.001$).

Anemia-related symptoms were frequently reported: 71% had headaches, 65% dizziness, and 58.3% fatigue. The mean symptom frequency was **46.94%.** Logistic regression indicated that fatigue ($\beta = 0.52$, $p < 0.05$) and dizziness ($\beta = 0.45$, $p < 0.05$) were significant predictors of treatment.

Regarding lifestyle, 78% ate leafy greens regularly, 80% had adequate hydration, and 55% reported sufficient sleep, but only 35% took supplements. The mean frequency of healthy behaviors was **62%.** Chi-square tests showed a significant association between supplement use and lower symptom burden ($\chi^2 = 16.73$, $p < 0.01$), while regression analysis identified diet ($\beta = 0.38$, $p < 0.05$) and sleep ($\beta = 0.31$, $p < 0.05$) as predictors of normal hemoglobin levels.

Overall, the results demonstrate significant associations between health behaviors, symptoms, and disease outcomes, underscoring the importance of early detection and preventive practices.

Table 1

Demographic characteristics of the study participants (n=150)

CHARACTERISTICS	FREQUENCY (N)	PERCENT %
GENDER		
Male	80	53.3
Female	70	46.7
AGE GROUP		
20-25	20	13.3

25-30	24	16.0
30-40	32	21.3
40 & Above	74	49.3
Diabetic patients	77	51
Healthy population	73	49

A total of **150 participants** were included in the study. The **majority were male (53.3%)**, while **females accounted for 46.7%**. The **most common age group** was **40 & above years**, comprising **49.3% of the sample**. Out of 150 participants, **51% (n = 77)** were diagnosed with type 2 diabetes mellitus (T2DM), and **49% (n = 73)** were non-diabetic. The **overall prevalence of anemia** among all participants was **44% (n = 66)**.

Table 2

Distribution of diabetes status of the study participants (n=150)

S.NO	STATEMENT	Yes	No
01	Have you been diagnosed with diabetes by a healthcare provider?	41.1%	58.4 %
02	Are you currently taking medication for diabetes?	76.0 %	24 %
03	Have you had diabetes for more than 5 years?	78%	22%
04	Do you monitor your blood sugar regularly?	72%	28%
05	Have you experienced any diabetes-related complications (e.g., foot ulcers, vision problems)?	51%	49%
	Mean	63.62%	36.28%

Table 3

Distribution of anemia status of the study participants (n=150)

S.NO	STATEMENT	Yes	No
01	Have you ever been diagnosed with anemia?	35%	65%
02	Have you been diagnosed with anemia in the past 6 months?	20%	80%

03	Have you ever received treatment for anemia?	82%	18%
04	Have you had a hemoglobin test in the last 6 months?	27%	73%
05	Was your last hemoglobin test result below normal?	45%	55%
06	Have you received a blood transfusion due to anemia?	12.5%	87.5%
07	Has your doctor ever prescribed iron supplements for you?	70%	30%
S	Mean	41.64%	58.36%

Table 4

Distribution of anemia symptom of the study participants (n=150)

S.NO	STATEMENT	Yes	No
	Do you often feel tired or weak?	58.3%	41.7%
	Do you experience shortness of breath during normal activity?	16.8%	83.2%
	Have you ever felt dizzy or lightheaded without a clear reason	65%	35%
	Have you noticed your skin becoming pale recently?	23.6%	76.4%
	Do you frequently experience headaches?	71%	29%
	Mean	46.94%	53.06%

Table 5

Distribution of life style status of the study participants (n=150)

S.NO	STATEMENT	Yes	No
	Do you eat green leafy vegetables more than twice a week?	78%	22%
	Do you take any vitamin or iron supplements?	35%	65%
	Do you drink more than 8 glasses of water daily?	80%	20%

	Do you sleep at least 7 hours a night?	55%	45%
	Mean	62%	38%

Discussion

This study reveals a substantial burden of diabetes, with high rates of diagnosis, treatment, and monitoring. The significant link between longer disease duration and complications highlights the need for early and ongoing management to prevent adverse outcomes. Anemia showed moderate diagnosis rates but high treatment levels, indicating possible under diagnosis. Routine hemoglobin testing was significantly associated with recent anemia diagnosis, emphasizing the value of regular screening. Symptoms such as fatigue and dizziness were significant predictors of treatment, suggesting symptom-driven healthcare seeking.

Lifestyle behaviors were generally positive, though supplement use was low. Significant associations between supplementation, diet, sleep, and anemia outcomes suggest lifestyle modifications are important in managing anemia.

Overall, these findings support enhanced screening, symptom awareness, and lifestyle interventions to improve chronic disease outcomes. Further research should explore causal links and intervention effectiveness.

Strengths

This study offers valuable insights into the prevalence and management of diabetes and anemia, combining both subjective symptom data and objective health behaviors. The use of statistical tests such as Chi-square and regression analysis adds rigor and helps identify significant associations between health conditions, symptoms, and lifestyle practices.

Limitations

The study is limited by its cross-sectional design, which restricts causal inference. Self-reported data may introduce recall or reporting bias. Additionally, the sample may not be representative of the wider population, limiting generalizability.

Recommendations

Future studies should employ longitudinal or experimental designs to explore causal relationships. Expanding the sample size and using objective clinical data (e.g., lab results) could enhance accuracy. Health education and community screening programs are recommended to improve early detection, promote healthier behaviors, and reduce the burden of chronic conditions.

Conclusion

The findings highlight the burden of chronic conditions such as diabetes and anemia in the studied population. Significant associations between disease duration, symptoms, and management practices underscore the importance of early diagnosis and continuous monitoring. Lifestyle factors, particularly diet, hydration, and adequate sleep, were found to significantly influence anemia-related outcomes.

These results suggest the need for community-based screening programs, targeted health education, and reinforcement of preventive practices. Integrating lifestyle modification strategies and routine clinical assessments into primary care can contribute to better management and reduced complications of chronic diseases.

References

Addo, O. Y., Emma, X. Y., Williams, A. M., Young, M. F., Sharma, A. J., Mei, Z., Kassebaum, N. J., Jefferds, M. E. D., & Suchdev, P. S. (2021). Evaluation of hemoglobin cutoff levels to define anemia among healthy individuals. JAMA network open, 4(8), e2119123-e2119123.

Arkew, M., Asmerom, H., Gemechu, K., & Tesfa, T. (2023). Global prevalence of anemia among type 2 diabetic adult patients: a systematic review and meta-analysis. Diabetes, Metabolic Syndrome and Obesity, 2243-2254.

Aschner, P., Karuranga, S., James, S., Simmons, D., Basit, A., Shaw, J. E., Wild, S. H., Ogurtsova, K., & Saeedi, P. (2021). The International Diabetes Federation's guide for diabetes epidemiological studies. Diabetes research and clinical practice, 172.

Bosman, D. R., Winkler, A. S., Marsden, J. T., Macdougall, I. C., & Watkins, P. J. (2001). Anemia with erythropoietin deficiency occurs early in diabetic nephropathy. Diabetes care, 24(3), 495-499.

Chen, H.-F., Ho, T.-F., Kuo, Y.-H., & Chien, J.-H. (2023). Association between Anemia severity and ischemic stroke incidence: a retrospective cohort study. International Journal of Environmental Research and Public Health, 20(5), 3849.

Ghamri, R., Salawati, E., Edrees, G. W., Alsaleh, A. K., Srouji, A. F., Radi, T. O., Feteih, M. M., Kary, M. S., Altalhi, R. J., & Almanasif, M. A. (2024). Anemia among adult patients with diabetes attending King Abdulaziz University Hospital: A retrospective study. Medicine, 103(33), e39383.

Hizomi Arani, R., Fakhri, F., Naeimi Tabiee, M., Talebi, F., Talebi, Z., Rashidi, N., & Zahedi, M. (2023). Prevalence of anemia and its associated factors among patients with type 2 diabetes mellitus in a referral diabetic clinic in the north of Iran. BMC Endocrine Disorders, 23(1), 58.

Kamerman, P. (2022). Underdiagnosis of hypertension and diabetes mellitus in South Africa. South African Medical Journal, 112(1), 53-60.

Köseoğlu, F. D., & Özlek, B. (2024). Anemia and iron deficiency predict all-cause mortality in patients with heart failure and preserved ejection fraction: 6-year follow-up study. Diagnostics, 14(2), 209.

Mezil, S. A., & Abed, B. A. (2021). Complication of diabetes mellitus. Annals of the Romanian Society for Cell Biology, 25(3), 1546-1556.

Obeagu, E. I., & Obeagu, G. U. (2025). Anemia and Cerebrovascular disease: pathophysiological insights and clinical implications. Annals of Medicine and Surgery, 10.1097.

Shah, Y., Patel, D., & Khan, N. (2021). Iron deficiency anemia in IBD: an overlooked comorbidity. Expert review of gastroenterology & hepatology, 15(7), 771-781.

Sun, J., Wu, H., Zhao, M., Magnussen, C. G., & Xi, B. (2021). Prevalence and changes of anemia among young children and women in 47 low-and middle-income countries, 2000-2018. EClinicalMedicine, 41.

Talukder, A., Sara, S. S., Hossain, M. T., Nath, C. D., Rahman, R., Hussain, S., Sarma, H., & Huda, M. N. (2024). Rural and urban differences in the prevalence and determinants of Type-2 diabetes in Bangladesh. PLOS ONE, 19(4), e0298071.

Uddin, S., Hameed, T., Ali, S. B., Saeed, M., Anjum, A., & Mubarak, M. (2025). Frequency of Anemia in Type 1 Diabetic Adolescent Patients in Tertiary Care Hospital of Karachi, Pakistan: Frequency of Anemia in Type 1 Diabetic Adolescent Patients. Pakistan Journal of Health Sciences, 289-294.