

Fiseha et al. (2019)	+	+	+	+	+	+	+	+
Grossman et al. (2013)	+	+	+	+	+	+	+	+
Hailu et al. (2020)	+	+	+	+	+	+	+	-
Wang et al. (2020)	+	+	-	-	+	+	-	-
sharif et al. (2014)	+	+	+	+	+	+	+	-
Kaushik et al. (2018)	+	+	+	+	+	+	+	-

Supplementary Figure S1. Quality assessment of cross-sectional studies included in this study on anemia in diabetes mellitus. According to the Newcastle-Ottawa Scale (NOS) criteria^[28,29].

Supplementary Table S1. Search keywords

Search strategy	Keywords
Anemia*[Title/Abstract] OR "Anemia"[Title/Abstract] OR iron deficiency,Anemia[MeSH] OR "iron deficiency"[Title/Abstract] OR iron deficiency* [Title/Abstract] OR Anamia [Title/Abstract] OR Anaemia [Title/Abstract] OR Anamia*[Title/Abstract] OR Anaemia*[Title/Abstract] OR anemi*[tw]	Anemia
Diabetes Mellitus[MeSH Terms] OR Diabetes Mellitus,Type 2[MeSH] OR Diabetes Mellitus,Type 1[MeSH] OR Diabetes Mellitus,Type 2 OR [Title/Abstract] OR Diabetic[MeSH Terms] OR Diabet*[tw] OR Diabetes Mellitus,Type 2[Title/Abstract]	Diabetes Mellitus
Prevalence[MeSH] OR Epidemiology[MeSH] OR Survey[MeSH]	Prevalence
1 AND 2 AND 3 AND	Search

Supplementary Table S2. Characteristics of the included studies in Meta-analysis

NO.	First author	Publication years	Country	Average age	Sample size	Type	N.	N. Duration of DM (year)	N. Poor Glycemic control (HBA1C > 7)	Prevalence anemia (%)	Quality score
1	Abat et al. ^[1]	2013	Africa	40/9 (16/8)	193	DM1	Metformin (160)	< 5 (206) 6-10 (124) > 11 (54)		4/2 78/1	7
2	adejumo et al. ^[2]	2012	Africa	48/8 (9/09)	144	DM2			80	15/3	6
3	Al-ghazaly et al. ^[3]	2019	Asia	53 (12)	324	DM2	Metformin (123)	< 5 (228) 6-10 (51) > 11 (45)		23/8	5
4	AL-Salman et al. ^[4]	2015	Asia	52/3 (14/1)	227	DM2				55/5	8
5	Argoon et al. ^[5]	2014	Africa	43/08 (9/3)	100	DM2				34	5
6	Arkew et al. ^[6]	2021	Africa	50 (16)	134	DM2	Metformin (24)	< 7 (24) > 7 (24)	78	17/9	7
7	Barbieri et al. ^[7]	2015	Africa	60/9 (8/9)	146	DM2				34/2	7
8	Awofisoy et al. ^[8]	2021	American	56/3 (11/5)	150	DM2	Metformin (133) Insulin (36)			45/5	7
9	Bekel et al. ^[9]	2019	Africa	62/3 (0/98)	410	DM2		< 5 (195) > 5 (177)	231	34/8	7
10	Bin-Bin He et al. ^[10]	2015	Asia	> 60	1 997	DM2				22	7
11	Chung et al. ^[11]	2017	Asia	57/8 (13/5)	2 230	DM2	Insulin (382)			31	7
12	Conway et al. ^[12]	2018	American	51/3 (9/1)	5 210	DM2					
13	Shaheen et al. ^[13]	2021	Africa	48/6 (15/9)	100	DM2					

Continued

NO.	First author	Publication years	Country	Average age	Sample size	Type	N. treatment-type	N. Duration of DM (year)	N. Poor Glycemic control (HBA1C > 7)	Prevalence anemia (%)	Quality score
14	Engidaw et al. ^[14]	2020	Africa	57 (11/5)	297	DM2					
15	Rathod et al. ^[15]	2018	Asia	24–72	100	DM2					
16	Gunvanti. Rathod et al. ^[16]	2016	Asia	58 (14)	200	DM2					
17	Hodel et al. ^[17]	2020	Africa	54 (19–91)	64	DM2					
18	Hosseini et al. ^[18]	2014	Asia	53/9 (1)	305	DM2	Insulin (29)				
19	Mirghani et al. ^[19]	2018	Asia	59/6 (9/9)	170	DM2					
20	Kebede et al. ^[20]	2021	Africa	> 60	372	DM2		< 5 (65) 6–10 (193) > 10 (114)			
21	Kim et al. ^[21]	2021	Asia	60/09 (0/31)	2 903	DM2					
22	Manglunia et al. ^[22]	2018	Asia	55/5 (13/7)	120	DM2					
23	Jin Ook Chung et al. ^[11]	2018	Asia	56/8 (9/5)	1 300	DM2					
24	Pehlivanoglu et al. ^[23]	2020	Asia	54/6 (11/8)	229	DM2					
25	Danish Qureshi et al. ^[24]	2020	Asia	56/9 (7/2)	117	DM2				56/4	
26	Panda et al. ^[25]	2018	Asia	51/3 (8/8)	54	DM2				63	
27	Shabeeb et al. ^[26]	2021	Asia	30–79	150	DM2				65/3	
28	Arshad et al. ^[27]	2021	Asia	54	227	DM2		< 5 (86) 6–10 (82) > 10 (83)		80	
29	Taderegew et al. ^[28]	2020	Africa	53/7 (10/4)	249	DM2		< 5 (102) 6–10 (84) > 10 (63)			
30	Tujuba et al. ^[29]	2021	Africa	40 (IQR:20)	325	DM2		< 5 (91) 6–10 (111) > 10 (123)			
31	Yorke et al. ^[30]	2021	Africa	54/8 (10/8)	195	DM2		< 5 (57) 6–10 (60) > 10 (75)			
32	Umeshchandara G et al. ^[31]	2021	Asia	54/1 (12/1)	230	DM2		< 5 (88) 6–10 (52) > 10 (25)			
33	Chio et al. ^[32]	2015	Asia	63 (11)	1 142	DM2					
34	Rathore et al. ^[33]	2018	Asia	< 50 > 60	200	DM2	Metformin (126)				
35	Wang et al. ^[34]	2020	Asia	59/8 (12/9)	901	DM2					
36	Shams et al. ^[35]	2015	Asia	51 (12/4)	130	DM2	Insulin (32)			98	
37	Ahmed et al. ^[36]	2017	Asia	56/5 (10/5)	640	DM2	Metformin (98) Insulin (32)				
38	Trevest et al. ^[37]	2014	European	83/6 (5/2)	115	DM2	Insulin (57)				
39	sarosh et al. ^[38]	2022	Asia	49/6 (13)	200	DM2					
40	Mulavu et al. ^[39]	2020	Asia	54/4 (14)	101	DM2	Metformin (7) Insulin (63)				
41	Aynalem et al. ^[40]	2022	Africa	54 (12)	357	DM2					
42	Idris et al. ^[41]	2018	Asia	60/5 (9/5)	808	DM2		< 5 (231) 6–10 (310) > 10 (266)			

Continued

NO.	First author	Publication years	Country	Average age	Sample size	Type	N. treatment-type	N. Duration of DM (year)	N. Poor Glycemic control (HBA1C > 7)	Prevalence anemia (%)	Quality score
43	Wali et al. ^[42]	2022	Asia	48/5 (7/5)	215	DM2					
44	Arani et al. ^[43]	2022	Asia	57/7 (8/6)	415	DM2					
45	Feteh et al. ^[44]	2016	Africa	56/5 (10/6)	636	DM2	Metformin (512) Insulin (68)				
46	Fiseha et al. ^[45]	2019	Africa	45 (14/6)	123 289	DM1 DM2		< 5 (253) 6–10 (107) > 10 (52)			
47	Grossman et al. ^[46]	2013	Asia	63 (9/6)	445	DM2	Metformin (335) Insulin (52)				
48	Hailu et al. ^[47]	2020	Africa	18–80	54 204	DM1 DM2					
49	Wang et al. ^[34]	2020	Asia	60/6 (11/4)	367	DM2					
50	sharif et al. ^[48]	2014	Asia	54/4 (9/5)	200	DM2			143		
51	Kaushik et al. ^[49]	2018	Asia	51–60	100	DM2					

REFERENCES

- 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 Blood Disorders*, 2013; 13, 6.
- Alsayegh F, Waheedi M, Bayoud T, et al. Anemia in diabetes: Experience of a single treatment center in Kuwait. *Prim Care Diabetes*, 2017; 11, 383–8.
- Fiseha T, Adamu A, Tesfaye M, et al. Prevalence of anemia in diabetic adult outpatients in Northeast Ethiopia. *PLoS One*, 2019; 14, e0222111.
- Muhammad K, Mohsin S, Pirzada S, et al. Frequency of anemia among the patients of type 2 diabetes attending outpatient clinic of mirpurkhas, sindh. *RADS J Biol Res Appl Sci*, 2020; 11, 89–95.
- Engidaw MT, Feyisa MS. Prevalence of anemia and its associated factors among adult diabetes mellitus patients at Debre Tabor General Hospital, Northcentral Ethiopia. *Diabetes, Metab Syndr Obes*, 2020; 13, 5017–23.
- Manglunia A, Yadav A, Saxena GN. Anemia its presence and severity in type 2 DM and its relationship with micro and macro vascular complications. *J Med Sci Clin Res*, 2018; 6, 1163–74.
- Tujuba T, Ayele BH, Fage SG, et al. Anemia among adult diabetic patients attending a general hospital in eastern ethiopia: a cross-sectional study. *Diabetes, Metab Syndr Obes*, 2021; 14, 467–76.
- Barbieri J, Fontela PC, Winkelmann ER, et al. Anemia in patients with type 2 diabetes mellitus. *Anemia*, 2015; 2015, 354737.
- Hosseini MS, Rostami Z, Saadat A, et al. Anemia and microvascular complications in patients with type 2 diabetes mellitus. *Nephrourol Mon*, 2014; 6, e19976.
- Arkew M, Yemane T, Mengistu Y, et al. Hematological parameters of type 2 diabetic adult patients at Debre Berhan Referral Hospital, Northeast Ethiopia: A comparative cross-sectional study. *PLoS One*, 2021; 16, e0253286.
- Shaheen ES. Prevalence of anemia in patients with type 2 diabetes. *J Med Sci Res*, 2019; 2, 114.
- Gauci R, Hunter M, Bruce DG, et al. Anemia complicating type 2 diabetes: prevalence, risk factors and prognosis. *J Diabetes Complications*, 2017; 31, 1169–74.
- Arshad SA, Ara J. Anemia in diabetes—an added dilemma. *Eur J Clin Med*, 2021; 2, 139–41.
- Sharif A, Younus S, Baig K, et al. Prevalence and risk of anemia in type-2 diabetic patients. *Health*, 2014; 6, 1415–9.
- Idris I, Tohid H, Muhammad NA, et al. Anaemia among primary care patients with type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD): a multicentred cross-sectional study. *BMJ Open*, 2018; 8, e025125.
- Al-Ghazaly J, Atef Z, Al-Dubai W. Pattern and causes of anemia in yemeni patients with type 2 diabetes mellitus. *Eur J Biomed*, 2019; 6, 66–74.
- Johnson-Wimbley TD, Graham DY. Diagnosis and management of iron deficiency anemia in the 21st century. *Therap Adv Gastroenterol*, 2011; 4, 177–84.
- A Manglunia, A Yadav, G Saxena. Anemia its presence and severity in type 2 DM and its relationship with micro and macro vascular complications. *J Med Sci and Clin Res*, 2018; 6, 1163–74.
- Intra J, Limonta G, Cappellini F, et al. Glycosylated hemoglobin in subjects affected by iron-deficiency anemia. *Diabetes Metab J*, 2019; 43, 539–44.
- Madhu SV, Raj A, Gupta S, et al. Effect of iron deficiency anemia and iron supplementation on HbA1c levels-Implications for diagnosis of prediabetes and diabetes mellitus in Asian Indians. *Clin Chim Acta*, 2017; 468, 225–9.
- Eyth E, Naik R. Hemoglobin A1c. StatPearls Publishing. 2019.
- Mulpuri N, Bryant A, Shahin D, et al. The hemoglobin wayne variant and association with falsely elevated HbA1c. *JCEM Case Rep*, 2023; 1, luad043.

23. Alzahrani BA, Salamatullah HK, Alsharm FS, et al. The effect of different types of anemia on HbA1c levels in non-diabetics. *BMC Endocr Disord*, 2023; 23, 24.
24. Mazumder H, Islam KF, Rahman F, et al. Prevalence of anemia in diabetes mellitus in South Asia: A systematic review and meta-analysis. *PLoS One*, 2023; 18, e0285336.
25. Bansal RK, Agarwal K, Goyal M, et al. Study of iron and vitamin b12 deficiency anaemia at glycosylated hemoglobin level: a case control study. *Indian J Basic Appl Med Res*, 2019; 8, 211–6.
26. Muhammed Shabeeb N, Siddiq A, Bharathi D, et al. A Study on prevalence of type ii diabetes mellitus patients with anemia in teaching hospital. 2021.
27. Taderegew MM, Gebremariam T, Tareke AA, et al. Anemia and its associated factors among type 2 diabetes mellitus patients attending Debre Berhan Referral Hospital, North-East Ethiopia: a cross-sectional study. *J Blood Med*, 2020; 11, 47–58.
28. Conway BN, Badders AN, Costacou T, et al. Perfluoroalkyl substances and kidney function in chronic kidney disease, anemia, and diabetes. *Diabetes Metab Syndr Obes*, 2018; 11, 707–16.
29. Gu LB, Lou QL, Wu HD, et al. Lack of association between anemia and renal disease progression in Chinese patients with type 2 diabetes. *J Diabetes Investig*, 2016; 7, 42–7.
30. Yorke E, Barnes NA, Akpalu J, et al. Predictors of anemia in Type 2 diabetes mellitus without renal disease. *Niger J Med*, 2021; 30, 494–500.
31. Aishhwarrya Umeshchandara G, Ramappa S, Rakshitha N, et al. A study of profile of anemia in patients with type 2 diabetes mellitus with normal renal function.
32. Choi JW, Kim TH, Han E. Anemia and incidence of dementia in patients with new-onset type 2 diabetes: A nationwide population-based cohort study. *BMJ Open Diabetes Research and Care*, 2020; 8, e001289.
33. Rathore S, Singh PK, Kumar A. Anemia in type 2 diabetes mellitus (T2dm) and its association with vitamin B12 deficiency. *Indian Journal of Pathology and Oncology*, 2018; 5, 51–4.
34. Wang J, Xin X, Luo W, et al. Anemia and diabetic kidney disease had joint effect on diabetic retinopathy among patients with type 2 diabetes. *Invest Ophthalmol Vis Sci*, 2020; 6, 25.
35. Shams N, Osmani M. Newly diagnosed anemia in admitted diabetics, frequency, etiology and associated factors. *J Coll Physicians Surg Pak*, 2015; 25, 242–6.
36. Ahmed K, Danial K, Khurram A, et al. To evaluate the renal function deterioration along with other anemia predictors in patients with diabetes mellitus type 2 in Karachi, Pakistan. *Pak J Surg*, 2017; 33, 135–9.
37. Trevest K, Treadway H, Hawkins-van der Cingel G, et al. Prevalence and determinants of anemia in older people with diabetes attending an outpatient clinic: a cross-sectional audit. *Clin Diabetes*, 2014; 32, 158–62.
38. Sarosh I, Ghafoor R, Haseeb A, et al. Frequency of anemia and its types in type II diabetes mellitus patients without renal insufficiency. *Pakistan Journal of Medical & Health Sciences*, 2022; 16, 216.
39. Mulavu M, Zulu M, Sinkala M, et al. Effects of blood sugar levels, kidney disease and medication on anaemia status of type 2 diabetes mellitus patients. *bioRxiv*, 2020.
40. Aynalem M, Getu F, Adane T. peripheral cytopenia and its associated factors in type 2 diabetes mellitus patients, Northwest Ethiopia. *J Blood Med*, 2022; 373–83.
41. Idris I, Tohid H, Muhammad NA, et al. Anaemia among primary care patients with type 2 diabetes mellitus (T2DM) and chronic kidney disease (CKD): a multicentred cross-sectional study. *BMJ open*, 2018; 8, e025125.
42. Wali AR, Kamar S, Manoli A, et al. Bhadang10, Prevalence of anemia among type 2 diabetes mellitus patients-a cross-sectional study. *European J Molecular & Clin Med*, 2022; 9.
43. Arani RH, Tabiee MN, Talebi F, et al. Prevalence of anemia and its associated factors among patients with type 2 diabetes mellitus in the north of Iran. 2022.
44. Feteh VF, Choukem S-P, Kengne A-P, et al. Anemia in type 2 diabetic patients and correlation with kidney function in a tertiary care sub-Saharan African hospital: a cross-sectional study. *BMC nephrology*, 2016; 17, 1–7.
45. Fiseha T, Adamu A, Tesfaye M. Prevalence of anemia in diabetic adult outpatients in Northeast Ethiopia. *PLoS One*; 2019; 14, e0222111.
46. Grossman C, Dovrish Z, Koren-Morag N, et al. Diabetes mellitus with normal renal function is associated with anaemia, *Diabetes Metab Res Rev*, 2014; 30, 291–6.
47. Hailu NA, Tolessa T, Gufue ZH, et al. The magnitude of anemia and associated factors among adult diabetic patients in Tertiary Teaching Hospital, Northern Ethiopia, 2019, cross-sectional study. *PLoS one*, 2020;15, e0240678.
48. Sharif A, Younus S, Baig K, et al. Prevalence and risk of anemia in type-2 diabetic patients. *Health*, 2014.
49. Kaushik D, Parashar R, Malik PK. Study of anaemia in type 2 diabetes mellitus. *Int J Res Med Sci*, 2018; 6, 1529–33.