e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 2189-2196

Original Research Article

Glycemic Control and Associated Factors Among type 2 Diabetes Mellitus Patients Attending at Tertiary Care Hospital

Satyam[1], Hashim Shah[2], Anant Prasad[3]

[1]Tutor, Department of Biochemistry, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar, India
[2]Tutor, Department of Biochemistry, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar, India
[3]Professor & Head, Department of Biochemistry, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar, India

Received: 27-04-2026 / Revised: 26-05-2026 / Accepted: 28-06-2026
Corresponding Author: Dr. Hashim Shah
Conflict of interest: Nil

Abstract:

Background: Poor glycemic control is the inability to maintain blood glucose levels within the recommended range and leads to elevated blood sugar levels over time, which cause significant risk factor for the development and progression of diabetes-related complications. Objective of the present study was to evaluate the glycemic control and associated factors among type 2 diabetes mellitus patients.

Methods: All data and completed prescriptions were collected on a case record form. Weight, height, and waist circumferences of the type II diabetes patients were recorded. Sociodemographic profile, Waist/Height ratio and BMI were obtained. Blood pressure was recorded. Glycated hemoglobin, lipid profile were analysed using the automated spectrophotometer.

Results: Out of 100 type 2 diabetes mellitus patients, most of the cases (38%) were in age bellow 50 years. Among 100 cases, only 10% cases had good glycemic control. Out of 68 male patients, 6(8.82%) cases had good glycemic control Out of 32 female type 2 diabetes mellitus patients, 4(12.5%) cases had good glycemic control. Out of 100 type 2 diabetes mellitus patients, 40 cases were obese cases, among them only 2(5%) cases had good glycemic control. 66 cases (W/H ratio) were 0bese. Among them only 3(4.54%) cases had good glycemic control. Dyslipidemia was present in 61 cases, among them 2(3.28%) cases had good glycemic control. 14(14%) who were treated with insuline alone or OHA with insuline had poor glycemic control.

Conclusion: Majorities of type 2 diabetes mellitus patients have poor glycemic control. Cardiovascular is the most common complication. BMI, central obesity and dyslipidemia are the most common contributing factors of poor glycemic control in type 2 diabetes mellitus patients. Hence, selfcare practice, dietary control and glucose management can affect the glycemic control in type 2 diabetes mellitus patients.

Keywords: Type 2 diabetes mellitus, Glycemic control, Risk factors, Dyslipidemia.

DOI: 10.25258/ijcpr.18.6.347

Introduction

The prolonged state of hyperglycemia will eventually result in multiple organ damage, leading to disabling and multi systems complications such as cardiovascular diseases, neuropathy, nephropathy, and retinopathy [1]. The prevalence of T2DM is rising at a faster rate in low- and middle-income countries than in high-income countries, with the Eastern Mediterranean and the South East Asian region recorded the highest prevalence [2].

Diabetes Mellitus (DM) is an escalating global health issue, with projections indicating that 98 million Indians could have diabetes by 2030 [3]. This prediction is driven by current figures, historical trends, changing risk factors such as diet and physical activity, and demographic shifts. Over the past five years, the global diabetes landscape has significantly evolved [4].

Diabetes is a public health emergency, is rapidly increasing in prevalence, and currently ranks among the four most common non-communicable diseases tracked by world health officials [5,6[. Globally, between 1980 and 2014, the number of people with diabetes increased from 108 million to 422 million, and the global prevalence of diabetes rose from 4.7% to 8.5% of the world's population over the same period.5 Estimates indicate 642 million cases of diabetes worldwide by 2040 [7,8]. In Africa, the average prevalence of diabetes is 0.3% and 7.0% for females and males, respectively, but only 3.8% overall for both sexes combined [9,10]. Glycemic control (GC) is important for preventing

complications and reducing healthcare costs, because hemoglobin A1c (HbA1c) level below 7% is associated with improved blood-glucose control and a reduced risk of long-term adverse complications of diabetes [11].

Poor glycemic control, which is the inability to maintain blood glucose levels within the recommended range and leads to elevated blood sugar levels over time, is a major public health issue and a significant risk factor for the development and progression of diabetes-related complications. Microvascular complications include diabetic retinopathy, diabetic nephropathy, and diabetic neuropathy [12], while macrovascular complications involve damage to larger blood vessels, leading to conditions such as coronary artery disease, heart attack, stroke, and peripheral artery disease [13]. These complications not only increase healthcare costs but also reduce life expectancy and quality of life. A prospective observational study across 23 hospital-based studies revealed a strong association between glycemia and the risk of clinical complications8. Studies from Sweden and the United States further emphasized the adverse outcomes and economic burden associated with poor glycemic control [14,15]. Achieving better glycemic control is essential for preventing the development and progression of diabetic complications [16], while also improving both life expectancy and quality of life for patients [17]. Objective of the present study was to evaluate the glycemic control and associated factors among type 2 diabetes mellitus patients attending at tertiary care hospital.

Material & Methods

The present study was conducted in the Department of Biochemistry with the collaboration of Department of Medicine, SKMCH, Muzaffarpur, Bihar, India during a period from October 2025 to February 2026. A total of 100 type 2 diabetes mellitus patients were enrolled in the present study.

Study Population: Type II diabetes mellitus patients who fulfilled the specified Inclusion and Exclusion Criteria were participated for the study.

Inclusion criteria

- Aged ≥18 years of age who is diagnosed with Type II Diabetes Mellitus was treated with OHA alone/Insulin alone/ OHA + Insulin (monotherapy or combination therapy) for minimum 4 months.
- Patients who agreed to sign the informed consent form were considered for study.

Exclusion criteria

- Patients with type 1 diabetes
- Pregnant women, women with gestational diabetes
- Patients with diabetes secondary to other factors like malnutrition, infection, surgery
- Patients who cannot sign the informed consent form
- Hospitalized and/or with psychiatric disorder during the data collection time (since there is a diabetes self-care practices assessment)

Case Record Form (CRF): A CRF was prepared to record the information of the Type II diabetes patients attending the medicine outdoor department of Hospital.

Socio-demographic Profile: Age and Gender of the Type II diabetic patients were noted. Anthropometric and metabolic profile show Body Mass Index (BMI). BMI was categorized as normal if BMI was less than 25 kg/m2, overweight if BMI was between 25 and 29 kg/m2 and as Obese if BMI was more than 30 kg/m2 [18,19].

Waist Circumference (WC): The Ideal WC for Males was considered as less than 90 cm), and less than 85 cm for females [20]. Waist/Hip ratio less than 0.9 was considered as ideal [20].

Study Procedure: All data and completed prescriptions were collected on a case record form. Weight, height, and waist circumferences of the type II diabetes patients were recorded. Weight was taken to the nearest 0.5 kg, and height was taken to the nearest 0.5 cm. Body Mass Index (BMI) was calculated as weight in kilograms divided by height in meter Squared. Blood pressure was measured using standardized sphygmomanometers. Blood pressure was recorded while the patient was in a sitting position with the arm at the level of the heart and after 5 min of rest. Blood samples were collected and glycated Hemoglobin, lipid profile was analyzed using the automated spectrophotometer. If these biochemical parameters were undertaken within last one–two months, the available last readings of HbA1c, fasting blood sugar measurements, and lipid profile [High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), triglyceride, and cholesterol] were abstracted from patients' records. Diabetes self-care was assessed by Diabetes Self-Management Questionnaire (DSMQ) [21].

Operational Definitions: Glycemic status was categorized as good glycemic control if HbA1c was below 7% and poor glycemic control if HbA1c was found to be more or equal to 7%. Lipid profile: The CH, HDL and LDL levels were recorded on the CRF. Criteria for abnormal lipid profile levels were based on the Indian Council of Medical Research criteria [22]. Hypercholesterolemia refers to a total cholesterol level ≥200 mg/dl. HDL was considered low when the level is below 40 mg/dl in males and below 50 mg/dl in females. LDL was considered high when the level was ≥100 mg/dl.

Hypertriglyceridemia refers to a level ≥150 mg/ dl. Dyslipidemia was defined as the presence of one or more of the previous abnormalities in serum lipids.

Statistical Analysis: Data was analysed with the help of IBM SPSS version 26 software. All data was tabulated and percentages were calculated. Chi-squared test was applied. P-value was taken less than or equal to 0.05 ($p \leq 0.05$) for significant differences.

Results

Out of 100 type 2 diabetes mellitus patients, most of the cases (38%) were in age bellow 50 years. 32% cases were in age group of 50-60 years and 30% were in age group of >60 years. In age group bellow 50 years, out of 38 cases, 5(13.15%) had good glycemic control. In age group 50-60 years, out of 32 cases, 3(9.37%) had good glycemic control. In age group > 60 years, of 30 cases, 2(6.67%) cases had good glycemic control. Out of 68 male patients, 6(8.82%) cases had good glycemic control and 62(91.18%) had poor glycemic control. Out of 32 female type 2 diabetes mellitus patients, 4(12.5%) cases had good glycemic control.

Table 1: Socio demographic profile of Type II diabetic patients in relation to glycemic control.

Parameter		**Total (N=100)**	**Good glycemic control (HbA1c < 7%)**	**Poor glycemic control (HbA1c >7%)**	**P-value**
Age	<50 years	38	5(13.15%)	33(86.84%)	<0.0001
	50-60	32	3(9.37%)	29(90.62%)	<0.0001
	>60	30	2(6.67%	28(93.33%)	<0.0001
Gender	Male	68	6(8.82%)	62(91.18%)	<0.0001
	Female	32	4(12.5%)	26(81.25%)	<0.0001

In the present study, out of 100 type 2 diabetes mellitus patients, 14(14%) cases had normal BMI. Out of 14 normal BMI cases, 3(21.43%) cases had good glycemic control. Out 46 overweight cases, 5(10.87%) cases had good glycemic control. Out of 40 obese cases, 2(5%) cases had good glycemic control. Out of 34 normal W/H ratio cases, 7(20.59%) cases had good glycemic control. Out of 66 0bese W/H ratio cases, 3(4.54%) cases had good glycemic control. Out of 29 total cholesterol >180 cases, 3(10.34%) cases had good glycemic control. Out of 24 cases of serum tryglyceride >150, 2(8.33%) cases had good glycemic control. Out of 25 cases of HDL cholesterol<45, 3(12%) cases had good glycemic control. Out of 22 cases of LDL cholesterol >100, 2(9.09%) cases had good glycemic control. Dyslipidemia was present in 61 cases, among them 2(3.28%) cases had good glycemic control. Dyslipidemia was absent in 39 cases, among them 8(20.51%) cases had good glycemic control and 31(79.49%) had poor glycemic control.

Table 2: Anthropometric and Metabolic Profile of Type II diabetic patients related to glycemic control.

Parameters		Total (N=100)	Good glycemic control (HbA1c < 7%)	Poor glycemic control (HbA1c >7%)	P-value
BMI (normal<25, overweight: 25-29, obese:≥30)	Normal	14	3(21.43%)	11(78.57%)	0.003
	Overweight	46	5(10.87%)	41(89.13%)	<0.0001
	Obese	40	2(5%)	38(95%)	<0.0001
W/H Ratio Men>0.9, Women >0.85	Normal	34	7(20.59%)	27(79.41%)	<0.0001
	Obese	66	3(4.54%)	63(95.45%)	<0.0001
Lipid Profile (mg/dl)	Total Cholesterol (>180)	29	3(10.34%)	26(89.66%)	<0.0001
	Serum Triglyceride (>150)	24	2(8.33%)	22(91.67%)	<0.0001
	HDL Cholesterol (<45)	25	3(12%)	22(88%)	<0.0001
	LDL Cholesterol (>100)	22	2(9.09%)	20(90.91%)	<0.0001
Dyslipidemia	Present	61	2(3.28%)	59(96.72%)	<0.0001
	Absent	39	8(20.51%)	31(79.49%)	<0.0001

In the present study, 64 patients had duration of type 2 diabetes mellitus patients was ≤7 years. Among them 8(12.5%) cases had good glycemic control. 36 patients had duration of type 2 diabetes mellitus >7 years. Among them, 2(5.56%) cases had good glycemic control.

Out of 100 type 2 diabetes mellitus patients, 36 cases had no any complications. 44 cases had 1 complication. Among them, 6(13.63%) cases had good glycemic control. More than one complication cases had poor glycemic control. Cardiovascular complication was seen in 42 patients. Among them, 5(11.90%) case had good glycemic control.

Table 3: Disease profile of Type II diabetic patients related to glycemic control.

Parameters		Total	Good Glycemic Control	Poor Glycemic Control	p-value
Duration of Diabetes	≤7 years	64	8(12.5%)	56(87.5%)	<0.0001
	>7 years	36	2(5.56%)	34(94.44%)	<0.0001
No of complications	0	72	7(9.72%)	65(90.28%)	<0.0001
	1	44	6(13.63%)	38(86.36%)	<0.0001
	2	16	0	16(100%)	<0.0001
	>2	4	0	4(100%)	
Diabetic Complications	Cardiovascular	42	5(11.90%)	37(88.09%)	<0.0001
	Neuropathy	9	0	9(100%)	
	Nephropathy	1	0	1(100%)	
	Catract	3	0	3(100%)	
	Ulcers	2	0	2(100%)	
	Hypothyroid	1	0	1(100%)	
	Hyperpigmentation	2	0	2(100%)	
	Retinopathy	2	0	2(100%)	
	Glaucoma	1	0	1(100%)	
	Cellulitis	1	0	1(100%)	
Hypertension	Yes	44	3(6.82%)	41(93.18%)	<0.0001
	No	56	7(12.5%)	49(87.5%)	<0.0001
Treatment Modality	OHA Alone	86	10(11.63%)	76(88.37%)	
	Insulin Alone	5	0	5(100%)	
	OHA+ Insulin	9	0	9(100%)	

Out of 100 type 2 diabetes mellitus patients, hypertension was seen in 44 cases. Among them 3(6.82%) cases had good glycemic control. 56 cases had no hypertension. Among them 7(12.5%) cases had good glycemic control.

Out of 100 type 2 DM cases, 86 patients were taken OHA alone. Among them 10(11.63%) cases had good glycemic control. All the patients 14(14%) who were treated with insuline alone or OHA with insuline had poor glycemic control.

Discussions

Poor and inadequate glycemic control constitutes a major public health problem and is a significant risk factor for the development and progression of diabetes related complications, which can markedly increase healthcare costs of the disease and reduce life expectancy and quality of life [23-25]. Glycemic control is considered the most effective means of preventing disease com plications [26]. However, a small proportion of patients maintain their blood sugar levels below 7% glycated hemoglobin (HbA1C), the ideal target for type 2 diabetes patients; 53–70% of diabetic patients have uncontrolled blood glucose levels and require help to prevent complications and reduce mortality [27].

In the present study, a total of 100 type 2 diabetes mellitus patients were included in the present study. Majority of the respondents (38%) were below 50 years followed by age 50-60 years (32%). This finding is inconsistent with findings of Angel Dominic et al. [28] where majority of studied population was between 40 to 60 years and Jambu Jain et al. [29] where most of the study population was between 50 to 60 years.

In the present study the male to female ratio was found to be 2.12 {male patients, 68%: female patients, 32%}. This trend is similar to study conducted in India Gopinath B el al. [30].

In the present study, majorities (64%) of the patient had diabetes below or equal to 7 years, while 36% had diabetes for more than 7 year which is similar to the study findings by Gopinath B el al. [30] where 60.2% of the patients had diabetes for less than 7 years. Overall prevalence of both macrovascular and microvascular complications was high in the study population. The cardiovascular complications were the most common (9=42%), followed by neuropathy (9%). Nephropathy was found in (1%) and cataract in (3%) cases. 2% had retinopathy,2% had ulcers, 1% patient had hypothyroidism ,2% had hyper pigmentation, 1% glaucoma which was similar the study conducted by Viswanathan Mohan et al. [31]. Viswanath Mohan et al. reported retinopathy (34.4 %); nephropathy, (20.4%); neuropathy, (28.8%); peripheral vascular disease, (65.4%) and

cardiovascular diseases (100%) among diabetic patients. Hence cardiovascular complication was the most common complication encountered in patients with Type II diabetes mellitus. Different studies from India and other countries have reported a similar observation about the co-morbidity prevalent in patients with diabetes [29,32].

Good metabolic control, right from the time of diagnosis of diabetes, is key to the prevention of chronic complications. Measurement of glycated hemoglobin (HbA1c) is now universally accepted as the most reliable indicator of long-term glycemic control because it accurately reflects an individual's blood glucose levels over the preceding 2-3 months. Assessment of the level of diabetes control in a population using HbA1c is a good indicator of the quality of diabetes care available to the population [33]. Assessment of the current glycemic status and the burden of diabetes related complications are therefore important in order to allocate community and health resources in any country and plan interventions to address the issues related to poor glycemic control. While there is lot of data in Western countries, such data are limited from developing countries like India [20].

The present study assessed the glycemic status among Type II diabetic patients and categorized them as having good glycemic control (HbA1c< 7 %).

In the present study as per the American diabetes association guidelines proportion of patients who have good (ideal) glycemic control were only 8.2%. Patients with poor glycemic control were sub grouped as those with satisfactory (HbA1c:7-8 %) and unsatisfactory (HbA1c >8%) glycemic control which was found to be 29% and 61% respectively. Despite the regular medical management, most of the patients (90%) were found to have poor glycemic control, i.e., were having HbA1c more than 7.0%. Similar observation was recorded in other study conducted by Gopinath B et al. [30] and Yonusmullug et al. [34]. Although glycemic control is known to reduce complications associated with diabetes, it remains an elusive goal for many patients with diabetes.

In the present study, out of 100 patients, 10% cases had good glycemic control and 90% cases had poor glycemic control. According to BMI, diabetic patients who were categorized as obese were more in the poor glycemic control group (95%) as compared to good glycemic control group (5%). Similar observation was seen in study by Gopinath B et al. [30], Maysaa Khattab et al. [35]. They found that most of obese patients had poor glycemic control. Also, majority (95.45%) of the patients who had central obesity had poor glycemic control. The results concur with findings by Luis A Vázquez et al. [36]. In the present study statistically, significant difference (P=0.044) was found between glycemic control and obesity. Similar observation was reported by Gopinath B et al. [30], Viswanathan Mohan et al. [31], Sasisekhar T.V.D et al. [37].

Most importantly almost all the diabetic patients with dyslipidemia (96.72 %) had poor glycemic control. Thus, statistically significant difference (P<0.0001) was found between dyslipidemia and glycemic control as observed previously by Yonas Mullugeta et al. [34], Gopinath B et al. [30], Maysaa Khattab et al. [35].

The American Association of Diabetes Educators Outcome Standards for Diabetes Education specifies self-care management behavior as the key glycemic control outcome. Effective self-management is one (but not the only) contributor to longer term, higher-order outcomes such as clinical status (e.g., control of glycemia, blood pressure, and cholesterol), health status (e.g., avoidance of complications), and subjective quality of life. Thus, patient self-management behaviours are at the core of the outcomes evaluation.

Effective educational and therapeutic approaches should be focused on enhancing dietary control, glucose management, weight control, management of dyslipidaemia, and optimizing glycemic control. Thus, there is a need to increase awareness among patients and healthcare providers regarding the importance of good glycemic control, so that decisions on treatment escalation can be taken and implemented at the appropriate time and patients can protected from the ill effects of the accumulated and potentially avoidable glycemic burden. In the present study, majority of the diabetic patients had poor glycemic control values (90%). The study had some limitations. One of the limitations was that confounding factors, such as diet and the quantification of sugar intake, were not carried out and sample size was small. There was no patient follow up or active interventions administered to diabetic patient with poor glycemic control that could impact glycemic outcomes.

Several factors contribute to poor glycemic control in individuals with diabetes, including poor medication adherence, unhealthy dietary habits, poor self-care practices, a longer duration of diabetes, low education levels, physical inactivity, obesity, hypertension, and the type of treatment [38,39]. However, conflicting results exist across studies. For example, a study from the USA found a strong link between obesity, overweight, and poor glycemic control [40], while a study from Asia found no association between glycemic control and body mass index (BMI) or central obesity [41]. Additionally, some research indicated that glycemic control becomes more difficult with increasing age [42,43] while other studies found poorer glycemic control in younger individuals [44,45]. These

findings underline the inconsistencies across different populations and studies.

Conclusions

The present study concluded that the majorities of type 2 diabetes mellitus patients have poor glycemic control. Cardiovascular is the most common complication. BMI, central obesity and dyslipidemia are the most common contributing factors of poor glycemic control in type 2 diabetes mellitus patients. Self-care practice, dietary control and glucose management can affect the glycemic control in type 2 diabetes mellitus patients.

References

1. Papatheodorou K, Banach M, Edmonds M, Papanas N, Papazoglou D. Complications of Diabetes. J Diabetes Res. 2015;2015:189525. https://doi.org/10.1155/2015/189525 PMid:26247036
2. Chan M. Global report on diabetes. 2016;978:6-86. from: https://www.who.int/publications/i/item/9789241565257 [Last accessed on 2021 May 25].
3. International Diabetes Federation. IDF Diabetes Atlas, 10th Edition. 2022. Available from: https://diabetesatlas.org/ (Accessed on 25/04/2025)
4. Saeedi P, Petersohn I, Salpea P, et al. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas, 9th edition. Diabetes Res Clin Pract. 2019;157: 107843.
5. Ali MK, McKeever Bullard K, Imperatore G, Barker L, Gregg EW; Centers for Disease Control and Prevention (CDC). Characteristics associated with poor glycemic control among adults with self-reported diagnosed diabetes-National Health and Nutrition Examination Survey, United States, 2007 2010. MMWR Suppl. 2012; 61(2): 32-7.
6. Ethiopian Statistical Service. Projected population of Ethiopia 2025. Available from: https://ess.gov.et/download/projected-population-of-ethiopia-2025/
7. Chatterjee S, Khunti K, Davies MJ. Type 2 diabetes. Lancet. 2017; 389(10085): 2239-51.
8. Ethiopian Federal Ministry of Health. National strategic action plan for non-communicable diseases. Addis Ababa, Ethiopia 2016.
9. Fiseha T, Alemayehu E, Kassahun W, Adamu A, Gebreweld A. Factors associated with glycemic control among diabetic adult out-patients in Northeast Ethiopia. BMC Res Notes. 2018; 11(1): 316.
10. Gebreyohannes EA, Netere AK, Belachew SA. Glycemic control among diabetic patients in Ethiopia: a systematic review and meta-analysis. PLoS One. 2019; 14(8): e0221790.
11. American Diabetes Association Professional Practice Committee; Introduction and Methodology: Standards of Care in Diabetes—2024. Diabetes Care. 2024; 47(Supplement_1): S1-4.
12. Merid, F., Getahun, F., Esubalew, H. & Gezahegn, T. Diabetic microvascular complications and associated factors in patients with type 2 diabetes in Southern Ethiopia. Front. Endocrinol. 2024;15:1342680.
13. Stratton, I. M. et al. Association of glycaemia with macrovascular and microvascular complications of type 2 diabetes (UKPDS 35): prospective observational study. Bmj. 2000; 321 (7258): 405–412.
14. Ali, S. N., Dang-Tan, T., Valentine, W. J. & Hansen, B. B. Evaluation of the clinical and economic burden of poor glycemic control associated with therapeutic inertia in patients with type 2 diabetes in the united States. Adv. Therapy. 2020; 37: 869–882.
15. Hellgren, M. et al. The burden of poor glycaemic control in people with newly diagnosed type 2 diabetes in Sweden: a health economic modelling analysis based on nationwide data. Diabetes Obes. Metabolism. 2021; 23 (7):1604–1613.
16. LeRoith, D. & Smith, D. O. Monitoring glycemic control: the cornerstone ofdiabetes care. Clin. Ther. 2005; 27 (10): 1489–1499.
17. Valentine, W., Palmer, A., Nicklasson, L., Cobden, D. & Roze, S. Improving life expectancy and decreasing the incidence of complications associated with type 2 diabetes: a modelling study of HbA1c targets. Int. J. Clin. Pract. 2006;60 (9): 1138–1145.
18. American Diabetes Association. Standards of Medical Care in Diabetes. http://care.diabetesjournals.org/content/39/Supplement_1.S13.full.pdf: 22 Mar 2016.
19. Diagnostic Criteria ICMR Guidelines for Management of Type 2 Diabetes. Available from: http://icmr.nic.in/guidelines_diabetes/section3.pdf
20. World Health Organization Expert Committee (1995). Physical Status: The Use and Interpretation of Anthropometry; Technical Report Series No. 854, Geneva 1995: 427-438.
21. Schmitt A, Gahr A, Hermanns N, Kulzer B, Huber J, et al. The Diabetes Self-Management Questionnaire (DSMQ): development and evaluation of an instrument to assess diabetes self-care activities associated with glycaemic control. Health Qual Life Outcomes 2013; 11: 138.
22. Targets of glycemic control (2016) ICMR Guidelines for Management of Type 2 Diabetes- 2005. Available from:

http://icmr.nic.in/guidelines_diabetes/section4.pdf
23. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. Diabetes Res Clin Pract. 2010;87(1):4–14.
24. Lloyd A, Sawyer W, Hopkinson P. Impact of long-term complications on quality of life in patients with type 2 diabetes not using insulin. Value Health. 2001;4(5):392–400.
25. Stratton IM, Adler AI, Neil HA, Matthews DR, Manley SE, Cull CA, et al. Association of glycaemia with macrovascular and microvascular compli cations of type 2 diabetes (UKPDS 35): prospective observational study. Bmj. 2000;321(7258):405–12.
26. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni KJJD. Complications i. Factors associated with poor glycemic control among patients with type 2. Diabetes. 2010;24(2):84–9.
27. Buchanan D. Social epidemiology: Berkman, LF, Kawachi I (Eds) Oxford University Press, New York, 2000: 391. New York: Oxford University Press; 2003.
28. Dominic A, Joseph J, Augustin RM, Begum R, Nanjwade BK. Study of drug use evaluation on Oral Antihyperglycemic Agents in Type 2 Diabetes Mellitus and their potential Drug-Drug Interactions. World J Pharm Pharmaceut Sci 2016; 5: 1884-1896.
29. Jain J, Sharma P, Jain J, Raja M. Utilization pattern of oral hypoglycemic agents for diabetes mellitus type 2 patients attending out-patient department at tertiary care centre in Bhopal. Int J Basic Clin Pharmacol 2016; 5: 1826-1830.
30. Gopinath B, Sri Sai Prasad M, Jayarama N, Prabhakara K. Study of factors associated with poor glycemic control in Type -2 Diabetic patients. Glob J Med Pub Health, 2013.
31. Mohan V, Shah S, Saboo B. Current glycemic status and diabetes related complications among type 2 diabetes patients in India: data from the A1chieve study. J Assoc Physicians India 2013; 61: 12-15.
32. Satpathy SV, Dutta S, Upreti B, Bhutia N, Sharma DK. Utilization and Adverse reaction profile of Anti-diabetic drugs in a Tertiary Care Hospital in East Sikkim: A Cross-Sectional Observational Study. In Indian journal of pharmacology 2014; 46: S102-S102.
33. Unnikrishnan R, Rema M, Pradeepa R, Deepa M, Shanthirani CS, et al. Prevalence and risk factors of diabetic nephropathy in an urban South Indian population the Chennai Urban Rural Epidemiology Study (CURES 45). Diabetes Care 2007; 30: 2019-2024.
34. Mullugeta Y, Chawla R, Kebede T, Worku Y. Dyslipidemia associated with poor glycemic control in type 2 diabetes mellitus and the protective effect of metformin supplementation. Indian Journal of Clinical Biochemistry 2012; 27: 363-369.
35. Khattab M, Khader YS, Al-Khawaldeh A, Ajlouni K. Factors associated with poor glycemic control among patients with type 2 diabetes. J Diabetes Complications 2010; 24: 84-89.
36. Vázquez LA, Rodríguez A, Salvador J, Ascaso JF, Petto H, et al. Relationships between obesity, glycemic control, and cardiovascular risk factors: a pooled analysis of cross-sectional data from Spanish patients with type 2 diabetes in the preinsulin stage. BMC Cardiovasc Disord 2014;14: 1.
37. Sasisekhar TV, Shabana S, Bhargav SY. Gender: Does it have role has role in glycaemic control and diabetic distress in type 2 diabetes. IOSR-JDMS. 2013; 4: 48-51.
38. Sheleme, T., Mamo, G., Melaku, T. & Sahilu, T. Glycemic control and its predictors among adult diabetic patients attending Mettu Karl referral hospital, Southwest Ethiopia: a prospective observational study. Diabetes Therapy. 2020; 11: 1775–1794.
39. Pokhrel, S. et al. Self-care adherence and barriers to good glycaemic control in Nepalese type 2 diabetes mellitus patients: a hospital-based cross-sectional study. J. Multidisciplinary Healthc. 2019; :817–826.
40. Bae, J., Lage, M., Mo, D., Nelson, D. & Hoogwerf, B. Obesity and glycemic control in patients with diabetes mellitus: analysis of physician electronic health records in the US from 2009–2011. J. Diabetes Complicat. 2016; 30 (2): 212–220.
41. Al-Eitan, L. N., Nassar, A. M., Saadeh, N. A. & Almomani, B. A. Evaluation of glycemic control, lifestyle and clinical characteristics in patients with type 2 diabetes treated at King Abdullah university hospital in Jordan. Can. J. Diabetes. 2016; 40 (6): 496–502.
42. Kamuhabwa, A. R. & Charles, E. Predictors of poor glycemic control in type 2 diabetic patients attending public hospitals in Dar es Salaam. Drug, healthcare and patient safety. 2014 :155 – 65.
43. Maddah, M. & Attarpour, L. Glycemic control and its predictors among Iranian diabetic patients. Mediterranean J. Nutr. Metabolism. 2016; 9 (1):1–6.
44. Mahmood, M., Daud, F. & Ismail, A. Glycaemic control and associated factors among patients with diabetes at public health clinics in Johor. Malaysia Public. Health. 2016;135: 56–65.
45. Harrabi, I., Harbi, F. A. & Ghamdi, S. A. Predictors of glycemic control among patients with type 2 diabetes in Najran armed forces

hospital: a pilot study. J. Diabetes Mellitus.2014; 4 (02): 141–147.