

# Assessment of prevalence and pattern of comorbidities in hospitalized patients with uncontrolled hyperglycemia in Western Odisha



Bishwa Ranjan Sahoo<sup>a</sup> | Gurukrushna Mohapatra<sup>b</sup> | Jigyansa Mohapatra<sup>c</sup> |  
Namita Mohapatra<sup>d</sup>

<sup>a</sup>Bhima Bhoi Medical College, Odisha, India.

<sup>b</sup>Department of Community Medicine, IMS & SUM Hospital, Siksha O Anusandhan (Deemed to be) University, Odisha, India.

<sup>c</sup>Department of Pharmacology, Shree Jagannath Medical College, Puri, Odisha, India.

<sup>d</sup>Department of Medicine, PGIMER, Odisha, India.

**Abstract** Diabetes, especially type 2 diabetes, is one of the main global health problems and accounts for the highest morbidity and mortality worldwide. Due to its significant impacts on human life in terms of morbidity and health expenditures, diabetes has become a major public health concern worldwide. Apart from microvascular and macrovascular complications, other comorbidities found frequently in patients with diabetes are hypertension, obesity, chronic kidney disease, stroke, coronary heart disease, hypothyroidism, rheumatoid arthritis, chronic pulmonary disease and cancer. This was a hospital-based cross-sectional study to assess comorbidities in indoor patients of the Department of Medicine. All patients admitted with a history of diabetes or newly detected diabetes were identified, and relevant information was collected in a predesigned and pretested questionnaire. A total of 320 patients were assessed during the study period, of whom 52% were males and 48% were females. Most patients were in the age group of 51-60, followed by the 61-70 and 41-50 age groups. Hypertension was the most prevalent comorbidity, followed by dyslipidemia and chronic kidney disease. Approximately 42% of patients had one comorbidity, and 37% had two comorbidities simultaneously. The prevalence of comorbidities was higher and glycemic control was more compromised in those who had diabetes for a prolonged period.

**Keywords:** diabetes, comorbidities, hypertension, dyslipidemia

## 1. Introduction

In this era where noncommunicable diseases are emerging as a pandemic, diabetes mellitus is foreseen as a global threat, accounting for the highest morbidity and mortality worldwide (Alam et al 2014). It is a major public health concern because it enormously impacts the quality of human life as well as health expenditures. Economic transitions, industrialization, and extremely sedentary lifestyle and the marketing of highly processed and packaged food have contributed inadvertently to an increase in diabetes worldwide (Onyango and Onyango 2018). The increasing life expectancy of the human population could be another contributor to the global burden of diabetes (Oluyombo et al 2018; Sahu et al 2021). As per the global epidemiology, nearly 415 million adults are living with type 2 diabetes (T2DM), which shows a massive increasing trend in the prevalence of type 2 diabetes (International Diabetes Federation 2017). According to Global Health Estimates (2016), diabetes is one of the leading causes of mortality worldwide, and nearly 1.6 million deaths are related directly to diabetes. What is more alarming is that more than one-third of diabetes-related mortality occurs in people less than 60 years of age. (Alotaibi et al 2017). Controlling blood glucose through diet and lifestyle has always been suboptimal and neglected by many patients. This is largely due to the lack of awareness and health education to control diabetes (Ramtahal et al 2015; Al Slail et al 2016; Hasim et al 2017).

Uncontrolled diabetes for a long period manifests with a number of complications (Pati and Schellevis 2017). When associated with other existing chronic conditions, the complications of diabetes worsen. Apart from microvascular and macrovascular complications, other comorbidities found frequently in patients with diabetes are hypertension, obesity, chronic kidney disease, stroke, coronary heart disease, hypothyroidism, rheumatoid arthritis, chronic pulmonary disease and cancer (Waeber et al 2001; Sarwar et al 2010; United States Renal Data System 2014; Vondra et al 2005; Feary et al 2010). Almost 75% of diabetic patients have more than one comorbidity (Nowakowska et al 2018). These comorbidities can severely affect the quality of life but can be addressed effectively by proper patient management on a priority basis and the availability of healthcare services at an affordable cost (The Academy of Medical Sciences 2018). The coexisting conditions frequently result



in hospitalizations that need intensive care. A scientific analysis of the prevalence and progression of disease with different patterns of comorbidities may provide important information for better management and patient care. It could also provide a more patient-centric approach in the assessment of different risk factors so that therapeutic interventions can be tailored appropriately. Further analysis could lead to prediction of the presence of specific comorbidities, which can guide us to develop a planned and structured treatment strategy. With this background, the objective of the study is to assess the comorbidity pattern among hospitalized diabetic patients with uncontrolled hyperglycemia.

## 2. Material and methods

This study is a cross-sectional observational hospital-based study that was conducted in the Department of Medicine of Bhima Bhoi Medical College, Balangir, Odisha. The Balangir Municipality has a population of 98,238. The study period was from September 1 to December 31, 2021. The prevalence rate of diabetes was 27.19%, as was reported by the Chambers of Commerce and Industry of India (ASSOCHAM) in one of its research projects on diabetes and other NCDs in Odisha (The Statesman 2017). At a 95% confidence interval with a 5% margin of error in the population size of 98238, the sample size was calculated to be 304. A predesigned and pretested questionnaire was prepared in the Department of Medicine in collaboration with the Department of Community Medicine. The study was approved by the Institutional Ethical Committee of Bhima Bhoi Medical College, Balangir.

Adult patients (18 years and above) with newly diagnosed diabetes or diabetic patients already on treatment who were admitted to the Medicine department or ICU for various causes from September to December 2021 were included in the study. Patients who were critically ill and not willing to participate were excluded from the study. The study purpose was explained in detail, and written informed consent was obtained from the participants prior to data collection. Their age, sex, address, occupation, addiction, history of present illness, past history of any disease, duration of diabetes and medications taken were recorded in the pretested questionnaire. Findings of the general and systemic examinations were recorded in the prepared proforma. Laboratory investigations relevant to each patient which were available were recorded on the same day or the following day of hospitalization. Investigations included routine blood examination (TWBC, DC, Hb, FBG, PPBG, HbA1c, serum urea, creatinine, lipid profile, liver function tests, uric acid), thyroid function tests, rheumatoid factor, serum sodium, potassium and calcium, ECG, chest X-ray, CT scan, urine exam, ultrasound abdomen and pelvis. The different coexisting morbidity conditions present along with diabetes were assessed from the findings from physical examination and investigations. The different conditions that were searched for were hypertension, coronary artery disease, chronic kidney disease, dyslipidemia, stroke, hypothyroidism, rheumatoid arthritis, chronic obstructive pulmonary disease and cancer. The prevalence of these comorbidities in relation to age, sex, duration of diabetes, and glycemic control was studied.

### 2.1. Statistical analysis

All the collected data were documented in Microsoft Excel format and then analysed using SPSS version 16 (student version) in Department of Community Medicine. For descriptive statistics, categorical data were expressed in terms of numbers and percentages. Inferential statistics were applied through the chi-square test, and cross tabulation was performed using the crude odds ratio to find any significant association.  $P < 0.05$  was considered statistically significant.

## 3. Results

A total of 320 patients were assessed during the study period. Of them, 52% were males and 48% were females. Most patients were in the 51-60 years age group (26%), followed by 24% in the 61-70 years age group. The detailed demographic profile is shown in Table 1. On assessing the history of diabetes, 62% had diabetes in the past 1 to 5 years, 23% had diabetes for more than 5 years, and 15% were recently diagnosed with diabetes within the last 1 year. The mean HbA1c of the study population was 9.9%. In the comparison of the mean HbA1c of males and females by age group, the result was found to be statistically significant ( $P < 0.05$ ) (Table 2).

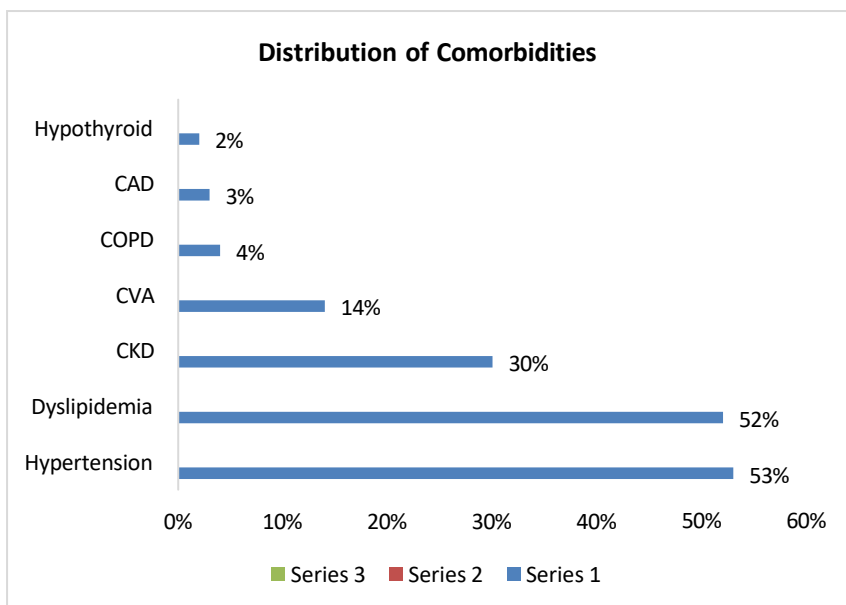
**Table 1** Age and sex distribution of the total study population.

Age (y)	Male n (%)	Female n (%)	Total n (%)
18-20	6 (2%)	0	6 (2%)
21-30	3 (1%)	26(8%)	29 (9%)
31-40	22 (7%)	22(7%)	44 (14%)
41-50	29 (9%)	36(11%)	65 (20%)
51-60	51 (16%)	31(10%)	82 (26%)
61-70	45 (14%)	32(10%)	77 (24%)
71-80	10 (3%)	7(2%)	17 (5%)
>80	0	0	0
Total	166 (52%)	154 (48%)	320

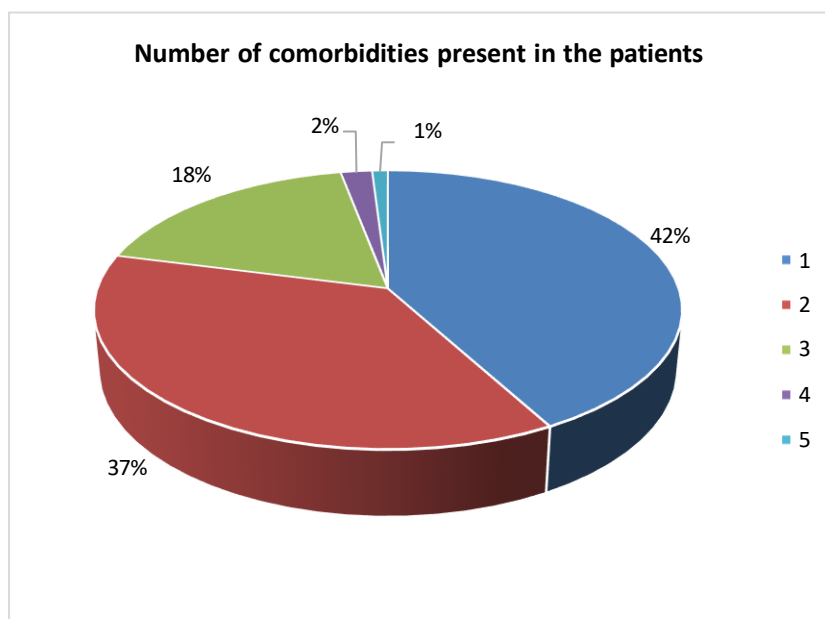
**Table 2** Average HbA1c related to the duration of diabetes.

<u>Duration of DM (years)</u>	<u>Male MEAN HbA1c (%)</u>	<u>Female MEAN HbA1c (%)</u>	<u>P Value (Chi- Square)</u>
1-5y	8.52	10.1	P<0.05, (10.04)
6-10y	10	8.8	
11-15y	9.4	11.4	
16-20y	10.6	9.8	
>20y	10.4	0	

On evaluation of comorbidities among the diabetic patients, 53% of patients had hypertension, dyslipidemia (elevated LDL and TG and low HDL) was found in 52%, CKD in 30% and coronary artery disease (CAD) in 3% of patients (Figure 1). Comorbidities such as hypertension, coronary artery disease, and dyslipidemia are equally distributed among males and females, but males are more vulnerable to stroke or CVA. Approximately 42% of diabetic patients had one comorbidity, and 37% had two comorbidities simultaneously (Figure 2). Around 94% of patients who had history of diabetes more than 5 years had various comorbidities. Age was found to be the most relevant predictor for diabetes with comorbidities [31-40 years, 1.11 (0.38-3.28)]. Similarly, employment and education had increased odds of having comorbidities [1.58 (0.64-3.29) and 2.20 (1.04-4.66)], respectively (Table 4).



**Figure 1** Distribution of Comorbidities.



**Figure 2** Number of comorbidities present in the patients.



**Table 3** Distribution of comorbidities among males and females.

Comorbidities	Male (n)	Female (n)	Total (%)
Hypertension	84	85	169 (53)
CAD	3	7	10 (3)
Dyslipidemia	84	83	167 (52)
CKD	49	47	96 (30)
CVA/Stroke	32	12	44 (14)
COPD	6	7	13 (4)
Hypothyroid	3	3	6 (2)

HTN-Hypertension, CAD-Coronary artery disease, DYSLIP-Dyslipidemia, CKD-Chronic kidney disease, CVA- Cerebrovascular accident, COPD-Chronic obstructive pulmonary disease, HYPO-Hypothyroidism.

**Table 4** Sociodemographic characteristics of type 2 diabetes patients, total and by comorbidity status (N = 320).

Socio Demographic Character	Morbidities Present	Morbidities Absent	P Value (Chi- Square)	OR (95% CI)
Sex				
Male	138	30	0.86	1.05 (0.59-1.85)
Female	125	27		
Age Group				
18-30	29	6	0.99	1.04 (0.32-3.34)
31-40	37	8		
41-50	52	12		
51-60	68	15		
61-70	76	17		
SES				
BPL	199	44	0.84	0.91 (0.46-1.81)
No BPL	64	13		
Place				
Urban	202	44	0.83	1.07 (0.55-2.08)
Rural	60	14		
Married	254	56	0.30	1.94 (0.48-7.73)
Unmarried	7	3		
Education				
Illiterate	86	19	0.15	1.08 (0.55-2.13)
Primary	92	22		
Secondary	37	18	0.75	1.42 (0.61-3.29)
University	35	11		
Unemployed	23	8	1.58 (0.64-3.29)	0.59 (0.22-1.59)
Employed	123	27		
Home Maker	72	15		
Retired	42	10		
Family H/O				
Yes	194	42	0.12	0.55 (0.25-1.19)
No	75	9		
BMI				
Under Weight	4	3	0.4	3 (0.60-14.77)
Normal	64	16		
Over Weight	46	11	0.95 (0.40-2.25)	0.88 (0.88-1.73)
Obese	144	32		

BPL- Below Poverty Line.

#### 4. Discussion

Our study included 320 diabetic patients, of whom 52% were male and 48% were female. Most of them belonged to the age group of 51-70 years. Talukder et al (2020) also found that the prevalence of diabetes was almost equal among female and male patients. The DECODA Study Group (2003) found that in patients of India and Singapore, the prevalence of DM was more than 10% among those aged 40–49 years and >30% among those aged 50–69 years for most of the cohorts.

In our study, 62% of patients had a history of diabetes for 1-5 years. As per the study of Sophia Zoungas et al (2014), the mean (±SD) diabetes duration was 7.9 ± 6.4 years. Hayashino et al 2017 also reported that 43% of patients had a diabetes duration of ≤5 years, which is similar to our study. Comorbidities were seen in 82% of our DM patients, equally distributed among males and females (Table 4), similar to Pati and Schellevis (2017), who found that 84% of patients suffered from comorbidities, and Nowakowska et al who reported comorbidities in 75% of diabetic patients. Iglay et al (2016) noted comorbidities in 97.5% of diabetic patients, which was more prevalent in men than in women.



Hypertension was seen in 53% of patients, with the maximum prevalence being in the 41-60 years age group. Similarly, Pati and Schellevis (2017) found hypertension to be the most common comorbidity (62%). Iglay et al (2016) found hypertension in a higher number of patients (82.1%). As per the study of Abdelbagi et al 47.6% of DM patients had hypertension and were in the age group  $\geq 45$  years. Geldsetzer et al (2018) observed in their study that diabetes along with hypertension is significantly high in middle and old age across all geographical areas and sociodemographic groups in India, similar to our study.

Coronary artery disease (CAD) was noted in 3% of patients (Figure 1), while it was seen in 21.6% of diabetic patients in the study by Iglay et al (2016). Einarson et al (2018) found that cardiovascular diseases affect approximately 32.2% of all persons with T2DM. As the study was performed in our new medical college, where we do not yet have a coronary care unit, most of our patients with acute myocardial infarction are referred to higher centres. Therefore, the number of patients with CAD could be low in our study. Dyslipidemia was noted in 52% of our patients, with the maximum prevalence being in the 41-60 age group (Figure 1), while it was seen in 65.6% in the study of Akin et al (2020) The most common finding in our study was elevated LDL and TG and low HDL. Chronic kidney disease (CKD) was found in 30% of our patients, with a maximum prevalence in the 41-60 age group. As per the study of Duan et al (2020) the overall prevalence of chronic kidney disease in patients with diabetes was 48.0%.

Chronic obstructive lung disease (COPD) was observed in 4% of our patients, while Pati and Schellevis (2017) found COPD in 8.3% of diabetic patients, and Stojkovicj et al (2016) reported that the prevalence of diabetes mellitus type 2 in COPD patients was 21%. Mannino et al (2008) also found that diabetes was present in 12.7% of COPD subjects. The lower number of COPD patients in our study could be due to COPD patients being admitted to the Department of Pulmonary Medicine.

## 5. Conclusions

It is well observed that there is a high prevalence of comorbidities in hospitalized patients with diabetes mellitus. In our study, hypertension was the most prevalent comorbidity, followed by dyslipidemia and chronic kidney disease. Patients who had a longer history of diabetes had inadequate glycemic control and a greater prevalence of comorbidities. Evaluation of comorbidities in diabetic patients could help strategize treatment plans, taking into account the multiple demands of comorbidities. This could propose designing chronic care management models focusing on patient-centred team care and integrated long-term treatment approaches.

## Ethical considerations

Not applicable.

## Conflict of Interest

The authors declare that they have no conflict of interest.

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