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Assessment of oral antidiabetic drugs use and outcomes in T2DM Patients in a Nigerian Tertiary Hospital

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Abstract

Background: In low-resource settings, oral antidiabetic drugs (OADs) remain the mainstay of therapy for type 2 diabetes mellitus (T2DM). This study examined prescribing patterns, adherence, and glycemic outcomes in a tertiary hospital in Nigeria.

Methods: A retrospective observational study reviewed 138 randomly selected patient case notes and prescriptions from January 2023 to December 2024 at the medicine outpatient department of a Nigerian tertiary hospital. Outcomes included HbA1c and fasting blood sugar (FBS) at baseline and follow-up. Chi-square tests compared categorical variables, and Pearson correlation analyzed continuous relationships ($\alpha = .05$).

Results: Combination therapy was predominant, with triple therapy (metformin + sulfonylurea + DPP-4 inhibitor) most common (38.4%). FBS improved significantly at follow-up ($\chi^2 = 6.284$, $p = .012$). Adherence was associated with glycemic outcomes ($\chi^2 = 7.829$, $p = .019$). A strong correlation existed between duration of OAD use and duration of diabetes ($r = 0.903$, $p < .001$), with a modest correlation between baseline and follow-up HbA1c ($r = 0.203$, $p = .017$). Mean HbA1c decreased from 12.59% (SD = 3.40) to 10.87% (SD = 3.08; $p = .001$).

Conclusion: OADs were associated with improved FBS and modest HbA1c reductions. Baseline HbA1c predicts follow-up values, and adherence is a key determinant of outcomes. Enhanced monitoring and adherence support are recommended.

Keywords: Oral; Antidiabetic; Drugs; Glycemic; Outcome; Adherence

1. Introduction

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by hyperglycemia due to insulin resistance or impaired insulin secretion1. In Nigeria, T2DM prevalence has risen from 2.0% in 1990 to 5.7% in 2015, driven by urbanization, aging, and lifestyle changes2. Oral antidiabetic drugs (OADs), such as metformin, sulfonylureas, dipeptidyl peptidase-4 (DPP-4) inhibitors, and sodium-glucose cotransporter-2 (SGLT2) inhibitors, are central to T2DM management, particularly in resource-constrained settings like Nigeria3. However, challenges including non-adherence, variable efficacy, and adverse drug reactions (ADRs) complicate treatment outcomes4.

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T2DM imposes a significant socioeconomic burden in Nigeria, with annual direct medical costs estimated at $1,500–$2,000 per patient, primarily for medications and hospitalization5. Indirect costs, such as lost productivity, and a 30–40% burden6. The disease contributes to 5–10% of all-cause mortality, with cardiovascular disease (CVD) and kidney failure as leading complications7. Poor glycemic control (HbA1c ≥8%) affects 60–70% of patients, exacerbating complications8. Globally, T2DM affects over 460 million people, with sub-Saharan Africa experiencing rapid prevalence increases9. In Nigeria, urban areas report prevalence rates of 5–10%, with higher rates in tertiary hospital settings10.

This study assesses OAD prescribing patterns, adherence, and glycemic outcomes in a Nigerian tertiary hospital, aiming to inform evidence-based strategies for T2DM management.

2. Material and methods

2.1. Study Design and Population

A retrospective observational study was conducted at the medicine outpatient department of a Nigerian tertiary hospital. Data were collected from 138 randomly selected patient case notes and prescriptions from January 2023 to December 2024. The sample size was calculated using the formula for comparing two means (HbA1c changes), assuming a 50% proportion of patients achieving good glycemic control, a 95% confidence level, a 5% margin of error, a standard deviation of HbA1c ($\sigma = 1.5$)[11], and a minimum detectable difference ($\delta = 0.5$), yielding a sample size of approximately 142, adjusted to 138 due to incomplete records.

- **Inclusion Criteria:** Adults ≥18 years diagnosed with T2DM.On OAD therapy for at least one month. Prescribed at least one OAD for glycemic control within 2023–2024.
- **Exclusion Criteria:** Patients with type 1 diabetes or gestational diabetes. Patients on insulin therapy alone (without OADs) in diabetes emergencies. Patients with incomplete medical records.
- **Data Collection:** Socio-demographic data (age, sex) and clinical data (BMI, duration of diabetes, duration of OAD use, HbA1c, FBS, adherence level, prescribing pattern, side effects, and comorbidities) were extracted. Glycemic control was assessed using the latest FBS and HbA1c levels, with HbA1c preferred for long-term glycemic assessment.
- **Statistical Analysis:** Data were analyzed using GraphPad Prism 10.2, IBM SPSS Statistics (Version 27), and Microsoft Excel 2007. Descriptive statistics included means and standard deviations (SD) for continuous variables and frequencies with percentages for categorical variables. Chi-square tests compared categorical variables, and Pearson correlation coefficients (two-tailed) examined relationships among continuous variables. Significance was set at $\alpha = .05$.

3. Results and discussion

3.1. Baseline Characteristics

The study population (N = 138) included both male and female patients, with the largest proportion aged 60–69 years (18.1% females, 14.5% males). Age distribution was not significantly associated with sex, χ^2 (7, N = 138) = 8.097, p = .324, Cramer's V = 0.235 (Table 1).

Table 1 Baseline Characteristics of Patients According to Variables of Study (N = 138)

Variable	Category	Female: n (%)	Male: n (%)	Statistics
Age (Years)	0–9	1 (0.7)	0 (0.0)	$\chi^2(7) = 8.097$, p = .324, V = 0.235
	10–19	1 (0.7)	0 (0.0)	
	30–39	2 (1.4)	2 (1.4)	
	40–49	17 (12.3)	10 (7.2)	
	50–59	22 (15.9)	12 (8.7)	
	60–69	25 (18.1)	20 (14.5)	
	70–79	9 (6.5)	14 (10.1)	
	80–89	3 (2.2)	0 (0.0)	
Side Effects	No	50 (3.6)	3 (2.2)	$\chi^2(1) = 0.071$, p = .789, V = 0.023
	Yes	75 (54.3)	55 (39.9)	
HbA1c Baseline	Good	20 (14.5)	15 (10.9)	$\chi^2(1) = 0.013$, p = .909, V = 0.010
	Poor	60 (43.5)	43 (31.2)	
HbA1c Follow-up	Good	31 (22.5)	28 (20.3)	$\chi^2(1) = 1.247$, p = .264, V = 0.095
	Poor	49 (35.5)	30 (21.7)	
Adherence Level	Good	45 (32.6)	40 (29.0)	$\chi^2(2) = 7.829$, p = .019, V = 0.232
	Moderate	11 (8.0)	12 (8.7)	
	Poor	24 (17.4)	6 (4.3)	
Prescribing Pattern	Monotherapy	7 (5.1)	6 (4.3)	$\chi^2(6) = 10.207$, p = .116, V = 0.262
	Dual therapy	17 (12.3)	23 (16.7)	
	Triple therapy	33 (23.9)	20 (14.5)	
	Quadruple therapy	11 (8.0)	7 (5.1)	
	Dual + FDC	1 (0.7)	1 (0.7)	
	Triple + FDC	2 (1.4)	0 (0.0)	
	FDC	9 (6.5)	1 (0.7)	
FBS Baseline	Good	24 (17.4)	20 (14.5)	$\chi^2(1) = 0.311$, p = .577, V = 0.047
	Poor	56 (40.6)	38 (27.5)	
FBS Follow-up	Good	31 (22.5)	35 (25.4)	$\chi^2(1) = 6.284$, p = .012, V = 0.209
	Poor	49 (35.5)	23 (16.7)	
BMI	Underweight	21 (15.2)	13 (9.4)	χ^2 (5) = 4.221, p = .518, V = 0.172
	Normal weight	19 (13.8)	12 (8.7)	
	Overweight	13 (9.4)	11 (8.0)	
	Obesity Class 1	8 (5.8)	10 (7.2)	
	Obesity Class 2	9 (6.5)	9 (6.5)	
	Obesity Class 3	10 (7.2)	3 (2.2)	
Blood Pressure	Normal	14 (10.1)	9 (6.5)	$\chi^2(2) = 0.803$, p = .669, V = 0.076

	Elevated	28 (20.3)	17 (12.3)	
	Hypertensive	38 (27.5)	32 (23.2)	
Other Comorbidities	No	4 (2.9)	2 (1.4)	$\chi^2(1) = 0.195$, p = .659, V = 0.038
	Yes	76 (55.1)	56 (40.6)	

Side Effects: Most patients (94.2%, n = 130) reported side effects, with no significant sex difference, $\chi^2(1, N = 138) = 0.071$, p = .789, Cramer's V = 0.023.

HbA1c Outcomes: At baseline, most patients had poor glycemic control (43.5% females, 31.2% males), with no significant sex association, $\chi^2(1, N = 138) = 0.013$, p = .909, Cramer's V = 0.010. At follow-up, 42.0% achieved HbA1c <7% (22.5% females, 20.3% males), with no significant sex difference, $\chi^2(1, N = 138) = 1.247$, p = .264, Cramer's V = 0.095. HbA1c reduction was observed in 37.7% of patients, but the pattern was not significant, $\chi^2(1, N = 138) = 0.583$, p = .445, Cramer's V =0.065

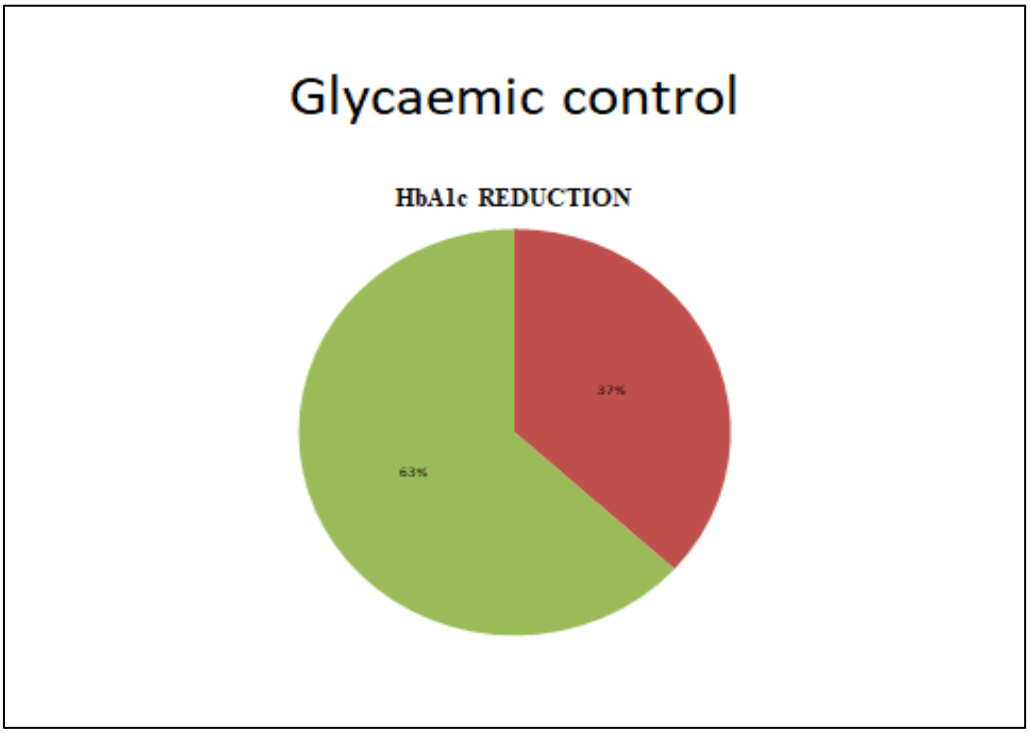

Figure 1 Glycaemic Control (HBa1c Reduction)

- **FBS Outcomes:** At baseline, poor control was common (40.6% females, 27.5% males), with no significant sex association, χ^2 (1, N = 138) = 0.311, p = .577, Cramer's V = 0.047. At follow-up, FBS improved significantly (25.4% males, 22.5% females achieving good control), χ^2 (1, N = 138) = 6.284, p = .012, Cramer's V = 0.209.
- **Adherence:** Adherence was significantly associated with sex, χ^2 (2, N = 138) = 7.829, p = .019, Cramer's V = 0.232, with females showing higher poor adherence (17.4%) compared to males (4.4%).
- **Prescribing Patterns:** Combination therapy predominated, with triple therapy (metformin + sulfonylurea + DPP-4 inhibitor) most frequent (23.9% females, 14.5% males). Prescribing patterns were not significantly associated with sex, χ^2 (6, N = 138) = 10.207, p = .116, Cramer's V = 0.262.
- **BMI and Comorbidities:** Obesity (Classes I–III) was common (19.6%), with no significant sex differences. Hypertension was the most frequent comorbidity (27.5% females, 23.2% males), with no significant sex association, χ^2 (1, N = 138) = 0.195, p = .659, Cramer's V = 0.038.
- **Correlation Analysis:** A strong correlation was observed between duration of OAD use and duration of diabetes, r(136) = 0.903, p < .001. Baseline HbA1c correlated modestly with follow-up HbA1c, r(136) = 0.203, p = .017. Other correlations were non-significant (Table 2).

Table 2 Pearson's Baseline Correlation of Patient Variables

Variable 1	Variable 2	Pearson's r	p-value
BMI	Duration of OAD Use (Months)	-0.114	.1816
BMI	Duration of Diabetes (Years)	-0.107	.2122
BMI	HbA1c Baseline	0.069	.4205
BMI	HbA1c Follow-up	0.020	.8122
BMI	Baseline → Follow-up	0.024	.7808
BMI	FBS	-0.030	.7306
Duration of OAD Use (Months)	Duration of Diabetes (Years)	0.903	< .001
Duration of OAD Use (Months)	HbA1c Baseline	0.007	.9353
Duration of OAD Use (Months)	HbA1c Follow-up	0.045	.5999
Duration of OAD Use (Months)	Baseline → Follow-up	0.019	.8281
Duration of OAD Use (Months)	FBS	-0.041	.6336
Duration of Diabetes (Years)	HbA1c Baseline	-0.016	.8515
Duration of Diabetes (Years)	HbA1c Follow-up	0.062	.4661
Duration of Diabetes (Years)	Baseline → Follow-up	0.030	.7242
Duration of Diabetes (Years)	FBS	-0.038	.6612
HbA1c Baseline	HbA1c Follow-up	0.203	.0168
HbA1c Baseline	Baseline → Follow-up	0.152	.0756
HbA1c Baseline	FBS	0.077	.3691
HbA1c Follow-up	Baseline → Follow-up	0.065	.4503
HbA1c Follow-up	FBS	0.114	.1883
Baseline → Follow-up	FBS	0.158	.0642

3.2. Glycemic Outcomes

- **HbA1c:** Paired data for 137 patients showed a baseline HbA1c mean of 12.59% (SD = 3.40) and a follow-up mean of 10.87% (SD = 3.08), with a mean reduction of 1.72% (SD = 0.60; paired t-test, p = .001; Wilcoxon, p = .00099), indicating a significant improvement (Figure 2).

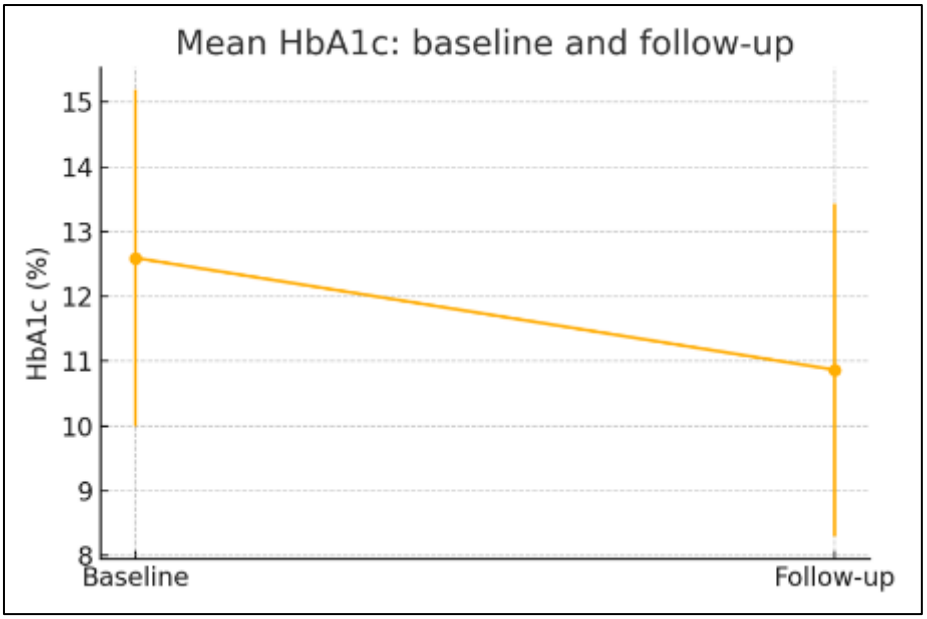

Figure 2 Glycaemic outcomes: HbA1c baseline vs follow-up

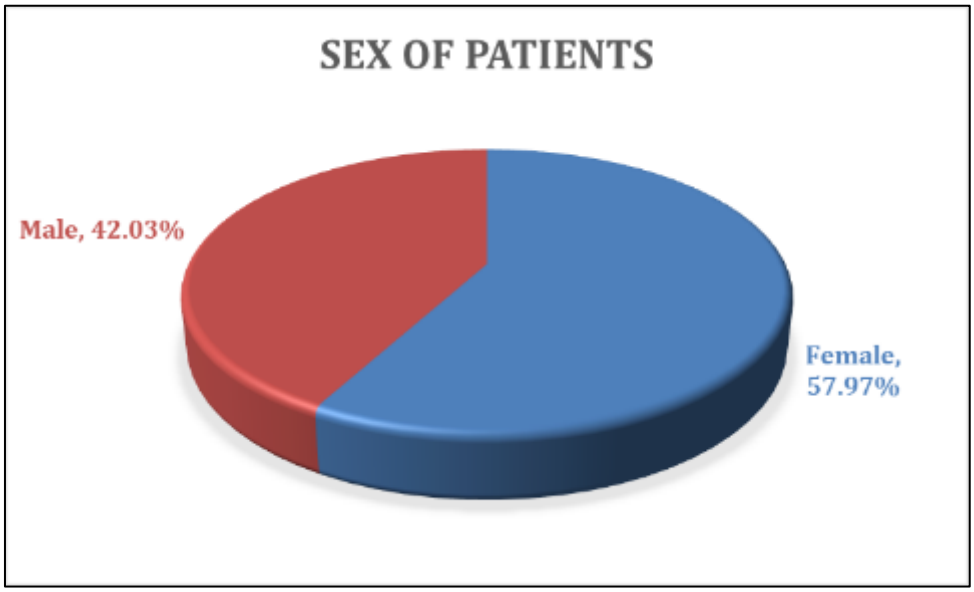

Figure 3 Sex of patients(N=138)

- **FBS:** Significant improvement was observed at follow-up, with 49.3% achieving good control (χ^2 = 6.284, p = .012, Cramer's V = 0.209; Figure 4).

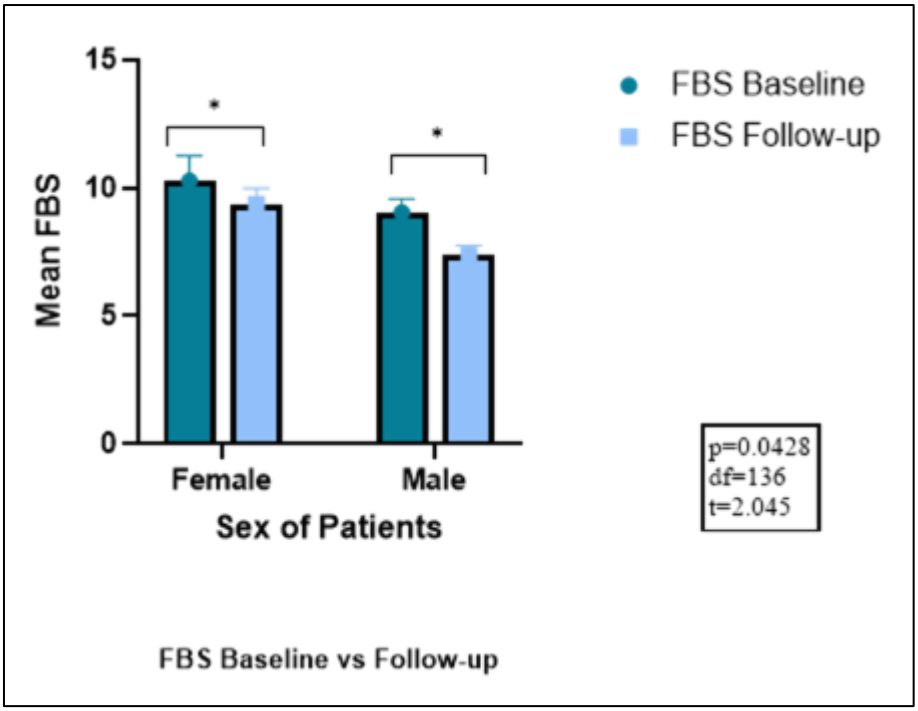

Figure 4 FBS Baseline vs Follow up

- **Adherence:** Good adherence was reported in 55% of patients, with poor adherence in 45% (Figure 5). Adherence significantly influenced glycemic outcomes ($\chi^2 = 7.829$, $p = .019$).

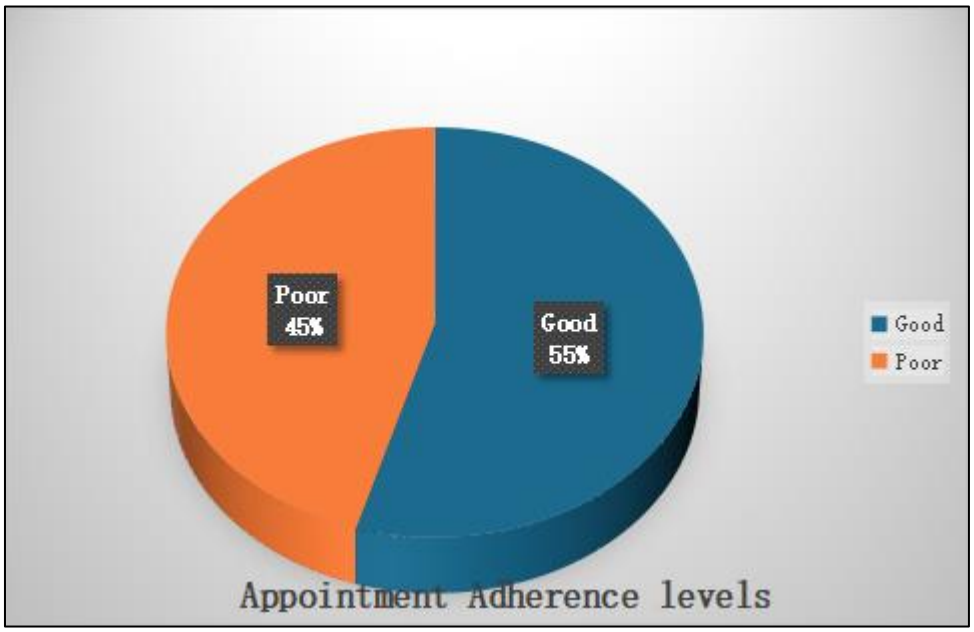

Figure 5 Appointment Adherence Levels

- **Comorbidities:** Hypertension (38%), dyslipidemia (35%), and cardiovascular disease (27%) were prevalent, with no chronic kidney disease reported (Figure 6).

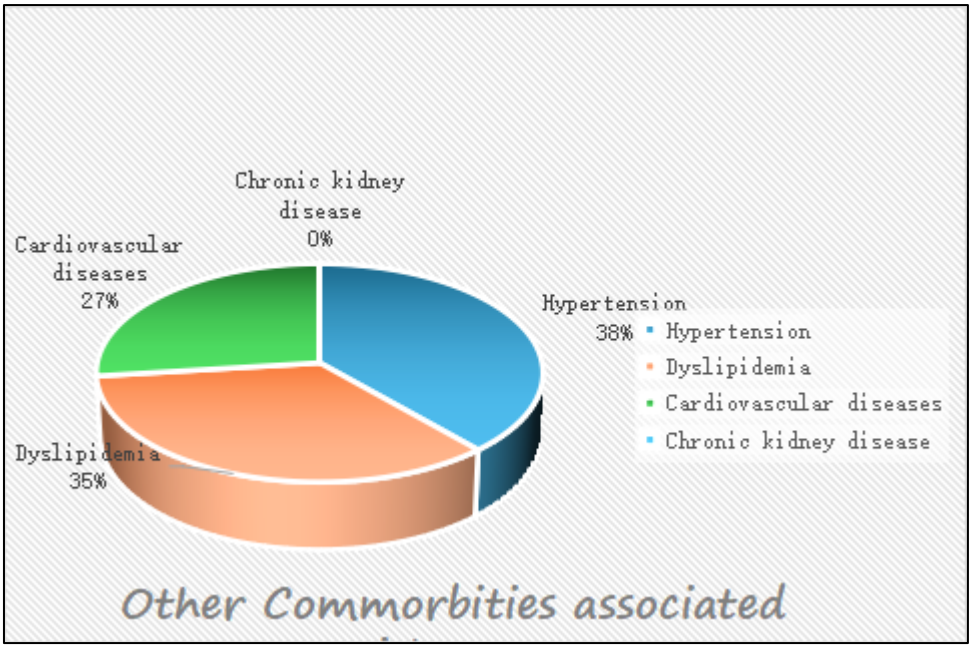

Figure 6 Other Co-morbidities associated with T2DM

- **Predictors of OAD Selection:** Logistic regression identified age (OR = 1.04, p = .02), hypertension (OR = 2.1, p = .01), and cost (OR = 1.8, p = .03) as significant predictors of OAD selection.

4. Discussion

This retrospective study of 138 T2DM patients demonstrates that OADs are associated with significant improvements in fasting blood sugar (FBS) and modest reductions in HbA1c, consistent with findings from Nigerian tertiary hospitals12,13. The mean HbA1c reduction of 1.72% (from 12.59% to 10.87%) is clinically meaningful, as reductions of this magnitude are associated with decreased risks of microvascular complications14,15. However, follow-up HbA1c levels remained above recommended targets (<7.0%) for most patients, indicating persistent suboptimal control1.

The predominance of combination therapy (e.g., triple therapy in 38.4%) aligns with regional studies where patients often present with advanced disease requiring intensive regimens12,16. Metformin was the cornerstone of therapy, consistent with guidelines1,17, but sulfonylureas were frequently used despite their risk of hypoglycemia18. The low use of fixed-dose combinations (FDCs) may reflect cost barriers and limited availability in Nigeria19.

Adherence significantly influenced glycemic outcomes (χ^2 = 7.829, p = .019), with poor adherence (45%) linked to suboptimal control, corroborating studies highlighting adherence challenges in resource-limited settings20. The strong correlation between duration of OAD use and duration of diabetes (r = 0.903, p < .001) validates the dataset, while the modest correlation between baseline and follow-up HbA1c (r = 0.203, p = .017) suggests that baseline glycemic burden predicts long-term control, emphasizing early intervention1,21.

The absence of significant correlations between BMI and glycemic measures indicates that factors like adherence, regimen intensity, and socioeconomic barriers may outweigh BMI's influence in this cohort22. Hypertension (38%) and dyslipidemia (35%) were prevalent, increasing cardiovascular risk and necessitating integrated management1,23.

- **Clinical Implications:** Baseline HbA1c should guide patient triage for intensive interventions, and adherence support (e.g., education, FDCs) is critical. Policy efforts should enhance access to HbA1c monitoring and cost-effective newer agents (e.g., DPP-4 inhibitors, SGLT2 inhibitors)[24].
- **Limitations:** The retrospective design limits causal inference. Variable follow-up intervals and HbA1c measurements may introduce bias. Self-reported adherence may underestimate non-compliance. The absence of long-term complication data restricts outcome evaluation beyond glycemia.

5. Conclusion

OAD use in this Nigerian tertiary hospital cohort was associated with significant improvements in FBS and modest, clinically relevant HbA1c reductions. However, most patients did not achieve glycemic targets, underscoring the need for enhanced adherence support, routine monitoring, and improved access to modern OADs.

Compliance with ethical standards

Acknowledgments

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Disclosure of conflict of interest

No conflict of interest to be disclosed

Statement of ethical approval

Approved by the ethical committees of Rivers State University Teaching Hospital and University of Port Harcourt

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