Research Square

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Prospective observational study of continuous glucose monitoring in adults with diabetes type 2 in Honduras: first real-world evidence from a Central American population

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Abstract

Purpose

Continuous glucose monitoring (CGM) provides real-time glycemic data by capturing glucose variability and daily fluctuations; however, real-world evidence on CGM implementation remains limited in lower income countries. This study aimed to evaluate glycemic outcomes associated with short-term CGM use among adults with type 2 diabetes in Honduras and to assess its feasibility in a resource-limited clinical setting.

Methods

A prospective observational study was conducted in a private outpatient clinic in Honduras. Adults (≥ 18 years) with type 2 diabetes underwent CGM for 14 consecutive days. Baseline glycemic control was assessed using laboratory-measured HbA1c, while post-monitoring glycemic status was estimated using the CGM-derived Glucose Management Indicator (GMI). Participants received therapeutic adjustments as part of routine clinical care. CGM-derived metrics were analyzed using descriptive statistics.

Results

Thirty-two participants were included (mean age 61.97 ± 12.76 years; 53.1% female). Mean baseline HbA1c was 9.01 ± 2.13%. The mean CGM-derived GMI was 7.22 ± 1.39%, corresponding to a mean estimated HbA1c reduction of − 1.79 ± 1.68%. Mean time in range (70–180 mg/dL) was 70.25 ± 26.35%, with 53.1% achieving the recommended ≥ 70% target. Mean glucose was 158.25 ± 43.20 mg/dL. Glycemic variability was low (coefficient of variation 26.43 ± 7.75%), with 90.6% below the 36% threshold. Time below range was minimal (0.75%).

Conclusion

Short-term CGM use in a real-world clinical setting in Honduras was associated with improved estimated glycemic control, favorable time in range, and low glycemic variability, supporting the feasibility of CGM implementation in resource-limited settings.

Introduction

Diabetes mellitus is among the most prevalent chronic diseases worldwide and a leading cause of morbidity and mortality due to its vascular complications. The International Diabetes Federation estimates that 537 million adults currently live with diabetes, a number projected to rise to 783 million by 2045 if effective interventions are not implemented. In Central and South America, prevalence is approximately 9.5%, and in Honduras it reaches 10.2%, corresponding to more than 350,000 affected adults and approximately 4,300 diabetes-related deaths annually [1].

Effective glucose monitoring is fundamental for preventing both acute and chronic complications. Traditionally, glycated hemoglobin (HbA1c) has been the gold standard for assessing long-term glycemic control; however, it does not capture daily glucose fluctuations, frequency of hypoglycemia, or glycemic variability, factors independently associated with microvascular and macrovascular outcomes [2,3].

Continuous glucose monitoring (CGM) has transformed diabetes management by providing dynamic metrics such as mean glucose, time in range (TIR), time below and above range, and glycemic variability. These parameters provide a more comprehensive characterization of glycemic patterns than HbA1c alone and are increasingly used to guide clinical decision-making [4,5]. International consensus statements define TIR ≥ 70% and glycemic variability < 36% as therapeutic targets associated with reduced complication risk [5].

Evidence from randomized and real-world studies suggests that CGM use is associated with improved glycemic control, reduced hypoglycemia, and enhanced treatment adherence in individuals with both type 1 and type 2 diabetes [6,7]. However, most available data originate from high-income countries, where access to diabetes technology is more widespread. In Latin America, CGM adoption remains limited due to economic constraints, fragmented healthcare systems, and the scarcity of region-specific evidence [8]. Although cost-effectiveness analyses indicate that higher initial device costs may be offset by reductions in hospitalizations and diabetes-related complications [9], these findings have rarely been validated in low- and middle-income settings. Recent regulatory changes, including approval of over-the-counter CGM devices in the United States, have expanded accessibility in some regions, yet global disparities persist [10,11].

In Tegucigalpa and the broader national context, real-world experience with CGM remains extremely limited. Access to these technologies is highly restricted, particularly within the public healthcare system, resulting in a substantial evidence gap regarding their use in routine clinical practice. To date, only a small case series has reported preliminary CGM outcomes in this setting [12], underscoring the need for larger observational evaluations. The present study was therefore designed to describe real-world glycemic outcomes associated with short-term CGM use, including CGM-derived metrics and estimated glycemic control, among adults with type 2 diabetes receiving care at a private outpatient clinic in Tegucigalpa, Honduras.

Methods

Study Design and Setting

This was a prospective, observational real-world study conducted at CAMI Health, a private outpatient diabetes clinic in Tegucigalpa, Honduras, between February and September 2025. The study aimed to describe glycemic outcomes associated with short-term use of continuous glucose monitoring (CGM) under routine clinical practice conditions. No study-specific interventions were implemented. This study was designed as a pilot real-world feasibility investigation to generate initial descriptive evidence regarding CGM implementation in Honduras. A formal sample size calculation was not performed

because this study was designed as an exploratory real-world observational analysis aimed at evaluating glycemic outcomes following short-term continuous glucose monitoring use. Participants were recruited consecutively based on device availability and eligibility during the study period. This pragmatic approach is consistent with prior CGM implementation studies and allows generation of preliminary data to inform future adequately powered prospective trials.

Potential limitations include selection bias, as participants were recruited from a private clinic population with greater access to diabetes technology, which may limit generalizability to the broader population receiving care in the public health system.

Written informed consent was obtained from all participants prior to CGM initiation. Ethical approval was granted by the Comité de Ética en Investigación Biomédica (CEIB) of the Faculty of Medical Sciences, National Autonomous University of Honduras (Approval No. IRB 00003070). The study adhered to the ethical principles of the Declaration of Helsinki. Personal identifiers were removed from all datasets to ensure confidentiality.

Study Population

Eligible participants were adults aged ≥ 18 years with a documented diagnosis of type 2 diabetes mellitus who underwent continuous glucose monitoring for at least 14 consecutive days using the Syai Tag CGM system.

Participants were recruited consecutively from individuals attending routine diabetes follow-up visits at CAMI Health during the study period. All patients who met eligibility criteria agreed to participate. A total of 32 individuals were included in the final analysis.

Exclusion criteria included: diagnosis of type 1 diabetes mellitus, incomplete or defective CGM recordings, acute illness during the monitoring period, major therapeutic changes unrelated to routine clinical care, incomplete medical records

During CGM use, participants continued to receive individualized treatment adjustments and lifestyle counseling as part of standard clinical management. No protocol-driven interventions were performed.

Data Collection

Clinical data were extracted from electronic medical records and digital reports generated by the Syai Tag CGM system (Syai Health Technology Pte. Ltd., Singapore). This device uses a subcutaneous sensor to continuously measure interstitial glucose and transmits data to a mobile application that generates standardized glycemic reports.

A structured electronic data collection form was developed for the study and reviewed by two investigators to ensure accuracy and completeness. All data were entered independently and verified by cross-checking.

Collected variables included:

- Sociodemographic and Clinical Variables: age (years), sex, body mass index (BMI, kg/m²), use of insulin therapy
- Laboratory parameters: baseline glycated hemoglobin (HbA1c) prior to CGM initiation
- CGM-Derived Metrics: mean glucose (mg/dL), time in range (TIR; 70–180 mg/dL), time above range (> 180 mg/dL), time below range (< 70 mg/dL), glycemic variability (coefficient of variation, %)
- Post-monitoring glycemic estimate: glucose management indicator (GMI), calculated automatically from CGM-derived mean glucose values
- Treatment variables: Insulin use, oral and injectable antidiabetic medications
- Comorbilities: Hypertension, dyslipidemia, chronic kidney disease, hypothyroidism, hyperuricemia and other comorbilities.

All data were anonymized and stored on password-protected computers accessible only to study investigators.

Patient and Public Involvement

Patients and members of the public were not involved in the design, conduct, reporting, or dissemination of this research.

Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics for Windows, version 31.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel. Given the exploratory, observational nature of the study and the small sample size, analyses were limited to descriptive statistics. Continuous variables were summarized as mean ± standard deviation (SD). Categorical variables were expressed as absolute frequencies and percentages. No inferential statistical testing, hypothesis testing, or regression analyses were conducted, as the study was designed to provide preliminary real-world descriptive evidence regarding CGM use in a resource-limited setting. Graphical representations, including box and scatter plots, were generated to illustrate the distribution of key clinical and CGM-derived variables. The primary outcome was descriptive change in estimated glycemic control following short-term CGM use, assessed by comparing baseline laboratory-measured HbA1c with the CGM-derived Glucose Management Indicator (GMI). Secondary outcomes included descriptive characterization of CGM-derived glycemic metrics, including time in range, glycemic variability, and glucose distribution patterns.

Results

A total of 32 adults with type 2 diabetes mellitus met inclusion criteria and completed continuous glucose monitoring (CGM) for 14 consecutive days.

Baseline characteristics

The cohort had a mean age of 61.97 years (SD 12.76), and 53.1% were female. The mean baseline HbA1c was 9.01% (SD 2.13), indicating overall poor glycemic control at study entry.

Regarding treatment, 46.9% of participants were receiving insulin therapy. The most commonly used oral antidiabetic agents were DPP-4 inhibitors (62.5%), followed by SGLT-2 inhibitors (59.4%), biguanides (34.4%), GLP-1 receptor agonists (28.1%), and sulfonylureas (25.0%).

Hypertension was the most prevalent comorbidity, affecting 71.9% of participants, followed by dyslipidemia (59.4%). Chronic kidney disease, hyperuricemia, and hypothyroidism were each present in 21.9% of individuals.

Detailed baseline characteristics are summarized in Table 1.

Table 1
Baseline demographic, clinical, and treatment characteristics of participants (n = 32)

Feature		n	%
Sex	Male	15	46.9
	Female	17	53.1
Age ranges	30–39	1	3.13
	40–49	2	6.25
	50–59	12	37.5
	60–69	7	21.88
	70–79	8	25.0
	+ 80	2	6.25
Years since diagnosis	0–4	2	6.25
	5–9	9	28.13
	+ 10	21	65.63
Family of antidiabetics	DPP-4	20	62.5
	SGLT2	19	59.4
	Insulin	15	46.9
	Biguanides	11	34.4
	GLP-1	9	28.1
	Sulfonylureas	8	25
Comorbilities	Hypertension	23	71.9
	Dyslipidemia	19	59.4
	Chronic Kidney Disease	7	21.9
	Hyperuricemia	7	21.9
	Hypothyroidism	7	21.9
	Other	9	28.1

Glycemic outcomes from CGM

The mean CGM-derived Glucose Management Indicator (GMI) was 7.22% (SD 1.39), corresponding to a mean HbA1c reduction of − 1.79% (SD 1.68) compared with baseline laboratory values.

The mean time in range (TIR) was 70.25% (SD 26.35), with 53.1% of participants achieving the recommended target of TIR ≥ 70%. Glycemic variability was generally low, with a mean coefficient of variation (CV) of 26.43% (SD 7.75), and 90.6% of participants maintaining CV below the clinical threshold of 36%.

Mean interstitial glucose measured by CGM was 158.25 mg/dL (SD 43.20). Time above range (TAR) averaged 26.69%, while time below range (TBR) was minimal at 0.75%.

These glycemic outcomes are summarized in Table 2.

Table 2
Glycemic outcomes derived from 14-day continuous glucose monitoring

Feature	**Mean ± SD**
Hb1Ac[a] (%)	9.01 ± 2.13
GMI[b] (%)	7.22 ± 1.39
Mean glucose (mg/dl)	158.25 ± 43.20
Time in Range [c] (%)	70.25 ± 26.35
Time above Range [c] (%)	26.69 ± 26.25
Time below Range [c] (%)	0.75 ± 1.70
Coefficient of Variation [d] (%)	26.43 ± 7.75
Adequacy variables	**n (%)**
TIR in target	17 (53.1)
TIR outside target	15 (46.9)
CV adequate	29 (90.6)
CV inadequate	3 (9.4)
a Laboratory–measured prior to CGM initiation	
b Estimated HbA1c derived from CGM data	
c Range defined as 70–180 mg/dL	
d Coefficient of variation; values <36% indicate acceptable glycemic variability	

Distribution of glycemic improvement

Visual comparison of baseline HbA1c and CGM-derived GMI demonstrated a clear downward shift in glycemic levels following CGM use (Fig. 1).

Higher TIR values were associated with lower baseline HbA1c levels, as illustrated in the scatter plot (Fig. 2).

Discussion

This study provides one of the first real-world descriptive evaluations of continuous glucose monitoring (CGM) use among adults with type 2 diabetes mellitus in Honduras, demonstrating favorable short-term glycemic profiles following a 14-day monitoring period. The observed median estimated HbA1c (GMI) was lower than baseline laboratory HbA1c, accompanied by high time in range (TIR) values and generally acceptable glycemic variability in most participants. These findings offer preliminary regional evidence supporting the feasibility and clinical utility of CGM implementation in a resource-limited outpatient setting.

The glycemic metrics observed in this cohort are consistent with international evidence demonstrating that CGM provides detailed characterization of glucose dynamics beyond conventional HbA1c assessment. Unlike HbA1c, which reflects average glycemia over several months, CGM captures real-time fluctuations, hypoglycemic exposure, and variability patterns that are independently associated with diabetes complications [2,3]. International consensus recommendations emphasize the importance of TIR ≥ 70% and glycemic variability below 36% as clinically meaningful targets linked to improved metabolic outcomes [5]. In the present study, most participants achieved TIR values near or above this threshold, suggesting adequate short-term glycemic stability within the monitoring period.

These observations align with findings from randomized clinical trials and meta-analyses demonstrating that CGM use is associated with improved glycemic profiles in individuals with type 2 diabetes. For example, a randomized trial showed that CGM use in insulin-treated adults with type 2 diabetes resulted in lower HbA1c values and improved glycemic stability compared with traditional self-monitoring approaches. [13] Similarly, systematic reviews have consistently reported that CGM improves TIR, reduces glucose variability, and enhances patient engagement with diabetes management [6,7,11]. The present study extends this evidence to a real-world clinical setting in Central America, where data remain scarce.

The short duration of monitoring in this study is noteworthy. Evidence suggests that even brief CGM exposure can improve patient awareness of glucose patterns and facilitate individualized therapeutic adjustments. Observational studies have shown that short-term CGM use enhances patient understanding of dietary and behavioral influences on glycemia, which may support improved treatment adherence [14–16]. The favorable glycemic metrics observed in this cohort likely reflect the combined effects of continuous monitoring, real-time feedback, and clinical decision-making based on CGM data.

Beyond clinical outcomes, the present findings are particularly relevant within the context of healthcare disparities in low- and middle-income countries. Access to CGM technology remains limited in many regions due to cost barriers and fragmented healthcare systems [8]. Although cost-effectiveness studies conducted in high-income settings indicate that CGM may reduce long-term healthcare expenditures by preventing complications and hospitalizations [17–19], similar economic evaluations are lacking in Latin America. The successful implementation observed in this study suggests that CGM integration is feasible even in resource-constrained environments when supported by specialized outpatient care.

In Latin America, recent regional consensus statements have emphasized the need for locally generated evidence to guide CGM adoption and standardization of glycemic metrics. Expert recommendations highlight the importance of harmonizing TIR, time above range, and variability indicators across clinical settings to improve comparability and policy development [20–22]. The present study contributes to this emerging regional evidence base by providing real-world data from Honduras, a country with minimal prior representation in diabetes technology research. The findings complement earlier preliminary reports from the region, including a small case series conducted in Tegucigalpa that demonstrated the feasibility of CGM use in urban outpatient care [12].

The observed glycemic variability levels in this cohort were generally within recommended thresholds, which is clinically relevant given the growing recognition of glycemic variability as an independent factor influencing diabetes complications. Studies have demonstrated that higher variability is associated with adverse cardiovascular and neurological outcomes, including increased risk in acute cerebrovascular events [23]. Additionally, CGM-derived variability metrics have been linked to metabolic conditions such as hepatic steatosis and insulin resistance [24]. These findings underscore the importance of assessing glucose stability alongside average glycemia when evaluating diabetes management.

From a public health perspective, CGM may play an important role in improving diabetes care quality and patient self-management. Continuous monitoring provides actionable data that enable both clinicians and patients to make timely adjustments to therapy and lifestyle behaviors. This interactive feedback mechanism has been associated with improved adherence and greater engagement in self-care practices [14–16,25]. Such benefits are particularly relevant in Latin American settings, where medication adherence remains suboptimal and healthcare access is unevenly distributed [25].

Despite these encouraging observations, several limitations should be considered. The study's sample size was modest, and participants were recruited from a private specialty clinic, which may limit generalizability to the broader Honduran population, particularly individuals receiving care in the public healthcare system. Additionally, post-monitoring glycemic control was assessed using the CGM-derived glucose management indicator (GMI) rather than a repeat laboratory HbA1c measurement. This distinction is important because HbA1c reflects average glycemia over approximately 8–12 weeks, whereas GMI is calculated from short-term interstitial glucose data obtained during the monitoring period and therefore represents more immediate glycemic trends. Consequently, the lower GMI observed in this study likely reflects early improvements in glycemic control following CGM use rather than a direct

biological change in HbA1c levels [3,9,11]. International consensus recommendations emphasize that CGM-derived metrics, including GMI and time in range, should be interpreted as complementary to HbA1c rather than interchangeable measures of glycemic control [20,22]. Furthermore, discordance between HbA1c and CGM indicators is well recognized and may result from biological variability in erythrocyte turnover, glycemic excursions, and limitations inherent to HbA1c as an average marker [6,24].

Nevertheless, the study has notable strengths. It represents one of the first structured real-world evaluations of CGM use in Honduras, includes standardized data collection procedures, and focuses on a population largely underrepresented in global diabetes technology research. The findings provide foundational evidence supporting the feasibility of CGM integration into routine diabetes care within resource-limited settings.

Future research should focus on larger prospective studies with longer follow-up periods to evaluate sustained glycemic outcomes, complication risk reduction, patient-reported quality of life, and economic impact. Expanding access to CGM technology in public healthcare systems and assessing its cost-effectiveness within local contexts will be essential for informing national diabetes management policies.

Conclusions

In summary, short-term CGM use among adults with type 2 diabetes in a real-world outpatient setting in Honduras demonstrated favorable glycemic metrics, including high time in range and acceptable glycemic variability. These findings are consistent with international evidence supporting the clinical utility of CGM and provide novel regional data highlighting its feasibility in resource-constrained environments. Broader implementation and long-term evaluation of CGM technology may contribute to improving diabetes outcomes and reducing the growing burden of disease in Latin America.

Abbreviations

(CGM) Continuous Glucose Monitoring, (HbA1c) Glycated Hemoglobin, (GMI)Glucose Management Indicator, (TIR)Time in Range, (TAR)Time Above Range, (TBR)Time Below Range, (CV) Coefficient of Variation, (SD)Standard Deviation, (BMI) Body Mass Index

Declarations

Patient consent for publication: All participants provided written informed consent.

Clinical trial number

not applicable

Compliance with Ethical Standards

Conflicts of interest: Elvin Omar Videa is the owner of CAMI Health

Ethics approval:

This study involves human participants and was an observational, prospective cohort study at Clínica Médica de Atención Integral (CAMI) in Tegucigalpa, Honduras. Ethical approval was issued by the Comité de Ética en Investigación Biomédica (CEIB) of the Faculty of Medical Sciences, National Autonomous University of Honduras No. IRB 00003070. All participants provided informed consent to participate in the study before taking part .

Competing Interests

Elvin Omar Videa is the owner of CAMI Health

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Author Contribution

OV, JR, and CS conceived and designed the study. OV, JR, CS, NM and KC analysed the data and wrote the manuscript. JR, NM and KC contributed to data collection and validation. OV, JR, CS and NM read and critically revised the manuscript for intellectual content. All authors contributed to data interpretation, reviewed and critically revised the manuscript, approved the final version, and agreed to be accountable for the accuracy and integrity of the work. OV is the guarantor of this study and accepts full responsibility for the work, had access to the data, and controlled the decision to publish.

Acknowledgement

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Data Availability

Due to patient confidentiality, the data generated and analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

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Figures

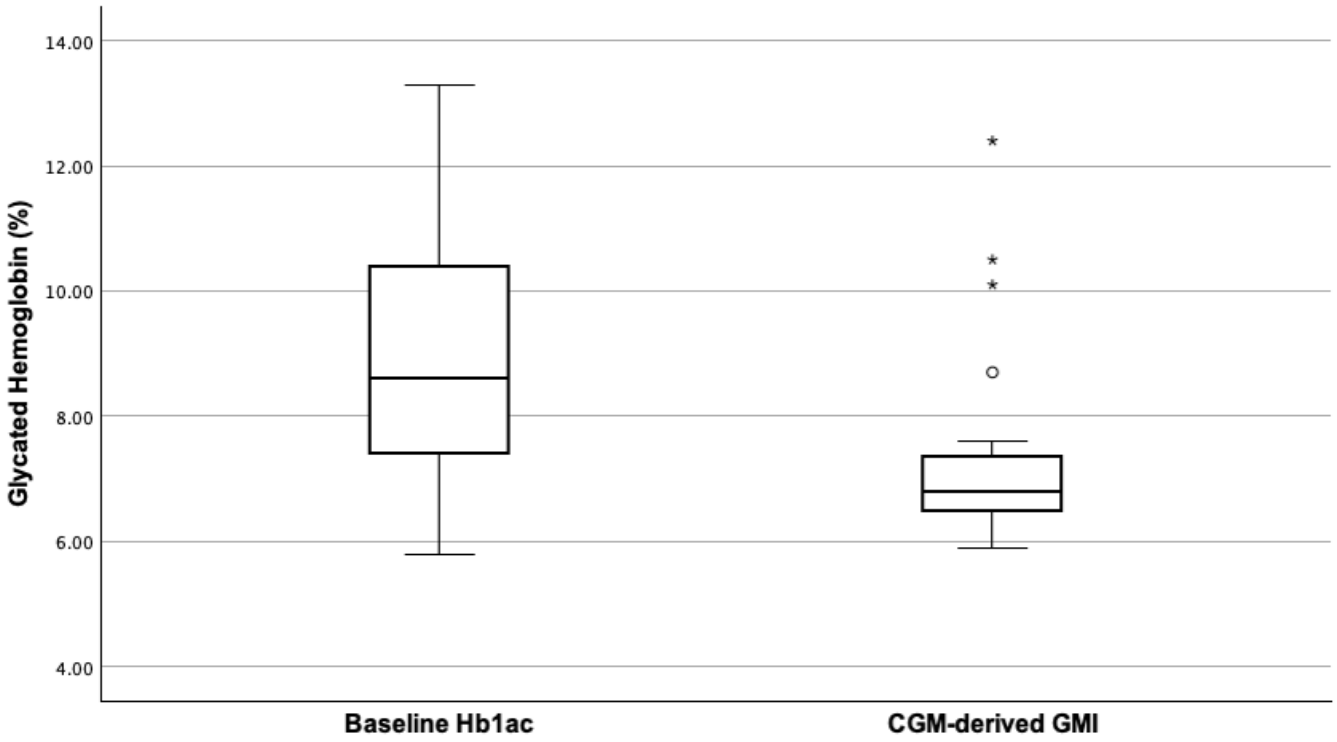


Figure 1

Comparison of baseline laboratory-measured HbA1c and CGM-derived Glucose Management Indicator (GMI) in adults with type 2 diabetes. Boxplots show median values, interquartile ranges, and outliers, demonstrating a consistent reduction in estimated glycemic levels following CGM use.

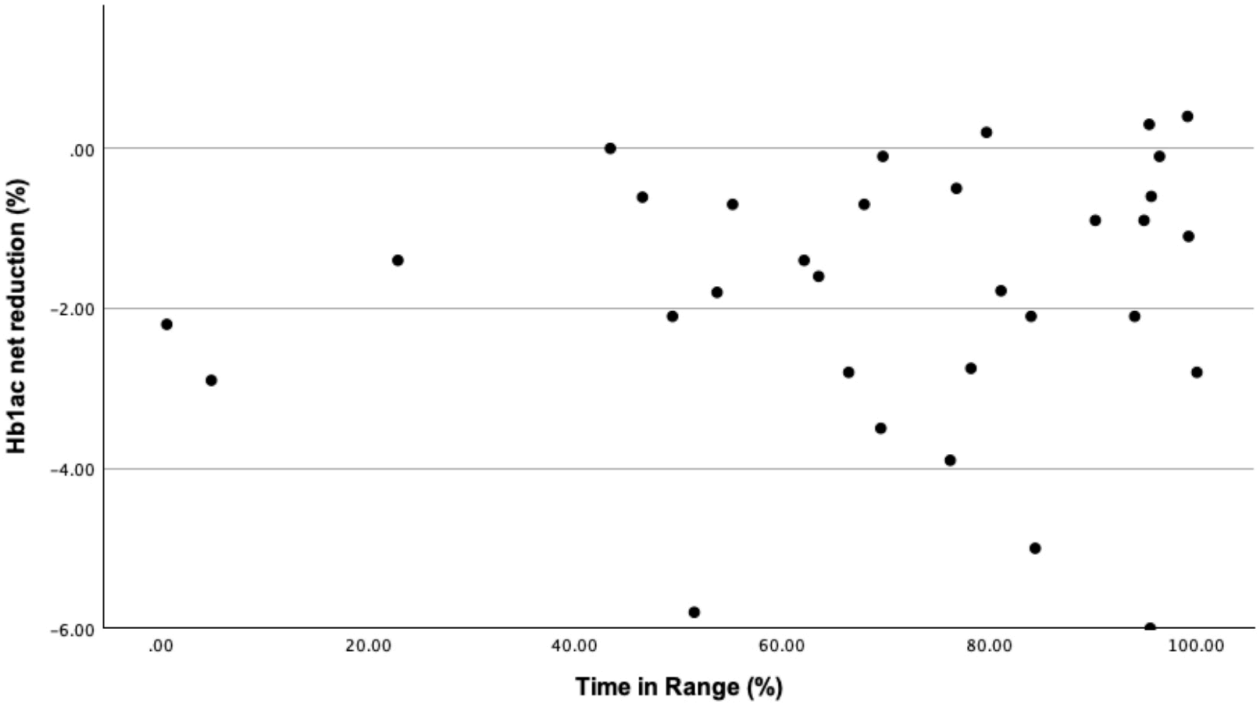


Figure 2

Scatter plot illustrating the relationship between time in range (TIR) and baseline HbA1c. Each point represents an individual participant. Higher TIR values were associated with lower baseline HbA1c levels.