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Original Article

Psychosocial impact of continuous glucose monitoring on mothers of children with type 1 diabetes: A cross-sectional study

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ABSTRACT

Background: Mothers of children with type 1 diabetes (T1D) often experience heightened anxiety and caregiver burden due to continuous management tasks and vigilance for hypoglycemia, especially overnight. Continuous glucose monitoring (CGM), by providing real-time glucose information and alerts, may be associated with changes in these psychosocial outcomes beyond glycemic indices. We evaluated whether CGM use is associated with maternal anxiety and caregiver burden and examined its relationship with glycemic control.

Methods: In this single-center, comparative cross-sectional study, mothers of children aged 2–18 years with T1D were grouped as CGM users (≥3 months) or non-users (never). Maternal anxiety (STAI-S/T) and caregiver burden (ZBI) were assessed; children's HbA1c and change in HbA1c (ΔHbA1c) were recorded. Group differences and adjusted associations were examined.

Results: A total of 130 mothers were included (CGM n=65; non-CGM n=65); children were 49.2% girls, with a mean age of 11.66 ± 3.84 years. Groups were generally comparable in sociodemographic and clinical characteristics; paternal education differed and was adjusted for. Diabetes duration was similar between groups: median (IQR) 2.94 (1.87–6.64) vs. 2.96 (1.83–5.99) years, p=0.419. Among mothers of CGM users, mean caregiver burden, state anxiety, and trait anxiety scores were lower than among non-users, and these associations persisted after adjustment for prespecified sociodemographic and clinical covariates. Children using CGM had the lowest most recent HbA1c (7.57 ± 0.97 vs. 8.20 ± 1.47). In CGM users, longer use was associated with lower maternal anxiety, whereas caregiver burden did not vary with duration. Neither HbA1c nor ΔHbA1c independently explained maternal anxiety or burden.

Conclusion: Among mothers of children with T1D, CGM use was associated with lower anxiety and caregiver burden, with an inverse association between duration of CGM use and anxiety. These patterns suggest that processes beyond glycemic averages—such as perceived control, alarm management, and day-to-day caregiving demands—may shape maternal well-being. Clinically, CGM counselling may be optimized by tailoring alarm settings and integrating device use into family routines; further multicenter studies with longer follow-up and time-sensitive CGM/psychosocial measures are warranted.

Keywords: type 1 diabetes, continuous glucose monitoring, caregiver burden, anxiety, mothers, pediatric endocrinology

INTRODUCTION

Type 1 diabetes (T1D) is one of the most common chronic endocrine conditions in childhood and requires continuous, multidimensional self-management in daily life.[1,2] In younger children, day-to-day management responsibilities largely fall to primary caregivers—most often mothers—disrupting family routines and sleep.[2] Recurrent stressors—frequent glucose monitoring, insulin titration, fear of hypoglycemia (particularly nocturnal), and nighttime awakenings—are associated with heightened maternal

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anxiety and increased caregiving burden, and with elevated parental diabetes distress more broadly.[2,3]

Against this backdrop, continuous glucose monitoring (CGM) has become a key technology in T1D care with clear psychosocial implications for families.[4] Psychosocial theories help contextualize parental caregiving experiences: within stress–coping models, parents' appraisal of diabetes-related demands and available resources shapes caregiver adjustment and distress.[5,6] Within the uncertainty-in-illness framework, illness-related ambiguity, treatment complexity, informational gaps, and the unpredictability of the disease course undermine perceived control and elevate distress; in T1D specifically, higher parental illness uncertainty prospectively predicts greater long-term psychological distress.[7,8] Qualitative work further shows that parents manage uncertainty through information seeking, social support, and technology use—including CGM—yet family life, especially with young children, often remains in a vigilant state of chronic disruption.[4,9] Within this rationale, CGM may reduce informational uncertainty and enable timelier responses—potentially attenuating anxiety—while device demands and continuous data vigilance may conversely amplify stress in some families.[4,9]

Consistent with these frameworks, we quantified maternal outcomes using validated self-report instruments. The State–Trait Anxiety Inventory (STAI) differentiates momentary (STAI-S) from dispositional (STAI-T) anxiety (20 items each; total scores 20–80), with higher scores indicating greater anxiety.[10,11] The Zarit Burden Interview (ZBI; 22 items; item scores 0–4; total 0–88) assesses perceived caregiving burden, with higher scores reflecting greater burden.[12,13] Both scales have Turkish validations with adequate reliability; therefore, we analyze them as continuous outcomes and refrain from applying non-validated categorical thresholds.[11,13]

By providing near real-time glucose information, CGM can facilitate earlier recognition of hypo- and hyperglycemia and may attenuate parental anxiety—particularly around nocturnal events.[14,15] Consistent with this rationale, studies report associations between CGM use and lower parental stress and fewer sleep disruptions. However, alarm notifications and continuous data visibility have also been linked to heightened vigilance and stress in some families.[14-17] Persistent parental diabetes distress is clinically relevant because it is associated with higher child HbA1c.[3]

Although CGM's effects on glycemic control have been extensively examined, caregiver-focused psychosocial impacts—particularly among mothers—remain less clearly characterized.[18] Much of the available evidence is qualitative or single-center observational, limiting precision and generalizability.[19,20] In middle-income settings such as Türkiye—where CGM access may be shaped by reimbursement policies, device availability, out-of-pocket costs, and variable health literacy and caregiving roles across socioeconomic strata—these psychosocial outcomes should be evaluated within their cultural and structural determinants.[2,21]

We aimed to assess the association between CGM use and maternal anxiety and caregiving burden—measured with STAI-S/T and ZBI—after adjustment for key sociodemographic covariates, and to explore associations with CGM duration and glycemic indices (HbA1c, ΔHbA1c).

METHODS

This single-center, comparative cross-sectional observational study examined the association between continuous glucose monitoring (CGM) use and maternal anxiety/caregiver burden among mothers of children with type 1 diabetes (T1D). The study was conducted jointly by the Departments of Psychiatry and Pediatric Endocrinology at Muğla Sıtkı Koçman University Faculty of Medicine. Data were collected between January and April 2025 in the Pediatric Endocrinology and Psychiatry outpatient clinics of Muğla Sıtkı Koçman University Training and Research Hospital.

Eligible participants were mothers of children aged 2–18 years with ≥1 year since a T1D diagnosis. Diabetes was confirmed per ISPAD 2022 pediatric criteria: laboratory plasma glucose meeting any of the following—random ≥200 mg/dL with classic symptoms; fasting ≥126 mg/dL after ≥8 h fast; or 2-h OGTT glucose ≥200 mg/dL; in asymptomatic presentations, diagnosis required confirmation on a separate sample. HbA1c ≥6.5% was considered diagnostic only when NGSP/DCCT-standardized assays were used, and no conditions affecting red-cell turnover were present. When clinical classification was uncertain, diabetes-associated autoantibodies (GAD, IA-2, IAA, ZnT8) supported T1D classification.[1]

Participants were classified as CGM users or non-users (never used). All CGM users employed the same flash CGM system (Abbott FreeStyle Libre 2; factory-calibrated; optional low/high-glucose alarms; no routine fingerstick calibration). To ensure exposure homogeneity, users of other CGM brands/models were excluded (noted as

a limitation for generalizability). No participants used continuous subcutaneous insulin infusion (CSII); all were on multiple daily injections (MDI), thereby reducing potential confounding from differential technology support and automation features.

Inclusion criteria were: (i) a child with T1D for ≥1 year, (ii) the mother's willingness to participate, and (iii) functional literacy sufficient to independently complete study questionnaires. Exclusion criteria were: (i) chronic comorbidities other than common T1D-associated autoimmune conditions (autoimmune thyroid disease, celiac disease), (ii) a self-reported or documented maternal psychiatric disorder, or (iii) a severe traumatic life event within the past 6 months. We did not conduct structured psychiatric interviews because the prespecified outcomes were self-reported anxiety and caregiving burden; validated questionnaires (STAI, ZBI) are feasible in routine clinical settings. Universal diagnostic interviews were not feasible within the clinic workflow and could introduce selection bias; undiagnosed conditions, therefore, cannot be ruled out. STAI/ZBI were analyzed as continuous, non-diagnostic indicators of symptom severity. STAI/ZBI were analyzed as continuous, non-diagnostic indicators of symptom severity.

Data were obtained via face-to-face interviews using three forms. The Sociodemographic Data Form recorded the mother's age, education, employment, marital status, family type, and income level; and the child's age, sex, diabetes duration, most recent HbA1c, and CGM status. For the CGM group, the initial HbA1c was defined as the most recent value prior to CGM initiation; for the non-CGM group, the initial HbA1c was obtained retrospectively from medical records approximately 3 months prior to study participation. For both groups, the second HbA1c was the most recent measurement at the time of participation. ΔHbA1c was calculated as (initial HbA1c − most recent HbA1c) so that positive values indicate improvement (reduction) and negative values indicate deterioration (increase).

Caregiver burden was assessed with the Zarit Burden Interview (ZBI; 22 items; item scores 0–4; total 0–88), with higher scores reflecting greater burden.[12] The Turkish validation reported excellent internal consistency (Cronbach's α ≈0.95).[13]

Maternal anxiety was assessed with the State–Trait Anxiety Inventory (STAI), comprising STAI-S and STAI-T subscales (20 items each; total scores 20–80), with higher scores indicating greater anxiety.[10,11]

The study was approved by the Clinical Research Ethics Committee of Muğla Sıtkı Koçman University (Approval Date: January 10, 2025; Decision No: 12). Written informed consent was obtained from all participants. The study adhered to the principles of the Declaration of Helsinki.

Because directly comparable prior studies using STAI or ZBI in parents of children with T1D were limited, we conducted an a priori power analysis for the primary between-group comparison (CGM vs. non-CGM) on STAI-T, assuming a conservative medium effect size (Cohen's d = 0.50) at a two-tailed α = 0.05. Using G*Power 3.1, this required approximately 64 participants per group for 80% power. Our realized sample (n = 65 per group; total 130) yielded an achieved power ≈0.81 for d = 0.50 under a two-sample t-test with equal allocation, meeting the target to detect clinically meaningful differences.

Analyses were performed in SPSS v22.0. Distributional assumptions were evaluated using Shapiro–Wilk/ Kolmogorov–Smirnov tests and visual inspection of histograms and Q–Q plots. Descriptive statistics are presented as mean ± SD for approximately normal variables, and median (IQR) for skewed variables; categorical variables are n (%).

Between-group comparisons used independent-samples t-tests or Mann–Whitney U tests as appropriate; categorical variables were compared with χ^2 or Fisher's exact tests. Within-group change in HbA1c was assessed with the Wilcoxon signed-rank test, and between-group differences in ΔHbA1c with the Mann–Whitney U test.

Multivariable linear regression models were fitted for STAI-S, STAI-T, and ZBI. Prespecified covariates included maternal age, education, employment status, and a proxy for family income; paternal education; and child age, sex, and diabetes duration; and clinical variables were CGM use (0 = no, 1 = yes) and ΔHbA1c. We report unstandardized β coefficients, 95% CIs, p values, and adjusted R^2. Model assumptions (linearity, normality of residuals, homoscedasticity) were checked via residual diagnostics; multicollinearity was low (all VIFs < 2), and influential observations were screened (Cook's distance < 1).

Among CGM users, potential associations between CGM duration (months) and STAI-S, STAI-T, and ZBI were examined using Spearman correlations and multivariable linear regression, adjusting for maternal age, education, employment, family income, child age, diabetes duration, and ΔHbA1c. A two-tailed α of 0.05 defined statistical

significance. We assessed completeness of exposure, outcomes, and covariates; no missing data were identified, and analyses were conducted on a complete-case dataset.

RESULTS

A total of 130 mothers of children with type 1 diabetes were included in the study. Of the participants, 49.2% were girls (n=64) and 50.8% were boys (n=66). The mean age of all children was 11.66±3.84 years. Sixty-five children (50%) were using a continuous glucose monitoring (CGM) device, while 65 (50%) were not. Although the groups were generally comparable in sociodemographic and clinical characteristics, paternal education differed ($p = 0.002$). All multivariable models were adjusted for this variable (Table 1).

The most recent HbA1c level was significantly lower in the CGM group (7.57±0.97) compared to the non-CGM group (8.20±1.47; p=0.004). For within-group change, ΔHbA1c was defined as (initial HbA1c − most recent HbA1c; positive = improvement). In the CGM group, ΔHbA1c indicated a significant improvement (median: 0.2 [0.1–0.4] p<0.001), whereas in the non-CGM group, the within-group change was not significant (median: -0.1 [-0.1–0.0]; within-group p = NS). Between groups, ΔHbA1c values were significantly different, favoring CGM (Mann–Whitney p<0.001) (Table 1).

Caregiver burden was significantly lower in the CGM group (37.19±10.21 vs. 44.61±14.05; p=0.001). Similarly, state anxiety (36.46±7.69 vs. 42.15±6.50; p<0.001) and trait anxiety scores (40.26±5.69 vs. 49.59±6.49; p<0.001) were significantly lower in the CGM group (Table 2).

Among CGM users, CGM duration correlated inversely with anxiety: STAI-S ($\rho = -0.388$, $p = 0.0017$) and STAI-T ($\rho = -0.676$, $p < 0.0001$), whereas no correlation was observed with ZBI ($\rho = -0.084$, $p = 0.511$) (Table 3). These patterns were consistent with multivariable regression findings.

In models restricted to CGM users, longer CGM duration (per month) was associated with lower anxiety after adjustment for maternal age, education, employment, family income proxy, child age, diabetes duration, and ΔHbA1c: STAI-T $\beta = -4.06$ (95% CI −5.20 to −2.92, $p < 0.001$; adjusted $R^2 = 0.473$) and STAI-S $\beta = -3.78$ (95% CI −5.67 to −1.89, $p < 0.001$; adjusted $R^2 = 0.183$). No association was observed for ZBI ($\beta = -0.38$; 95% CI −3.17 to 2.42; $p = 0.788$) (Table 4).

Multivariable models (all participants): In models including all mothers and adjusting for maternal age, maternal education, maternal employment, family income proxy, paternal education, child age, sex, diabetes duration, and ΔHbA1c, CGM use (yes/no) remained inversely associated with maternal anxiety and caregiver burden: STAI-T $\beta = -8.80$ (95% CI −11.58 to −6.02, $p < 0.001$; adjusted $R^2 = 0.348$), STAI-S $\beta = -6.54$ (95% CI −9.73 to −3.35, $p < 0.001$; adjusted $R^2 = 0.134$), and ZBI $\beta = -6.11$ (95% CI −11.31 to −0.91, $p = 0.022$; adjusted $R^2 = 0.170$). In these adjusted models, HbA1c and ΔHbA1c were not independent predictors of STAI-S, STAI-T, or ZBI (all $p > 0.05$) (Table 5).

DISCUSSION

In this single-center, comparative cross-sectional study of 130 mothers of children with type 1 diabetes, maternal anxiety levels, measured with the State–Trait Anxiety Inventory (STAI-S/T), and caregiver burden, assessed with the Zarit Burden Interview (ZBI), were found to be lower among continuous glucose monitoring (CGM) users compared with non-users. These differences remained significant after adjustment for prespecified sociodemographic and clinical covariates. Among CGM users, longer duration of use was associated with lower anxiety, whereas caregiver burden did not vary with duration. In children, CGM use was associated with lower most recent HbA1c values and greater ΔHbA1c improvements; however, neither HbA1c nor ΔHbA1c independently explained maternal outcomes. This suggests that mothers' reports of anxiety and burden may be shaped by processes beyond metabolic averages, such as perceived control, alarm management, and daily caregiving routines.

In our study, CGM use was associated with lower maternal anxiety (STAI-S/T), which aligns with previous reports showing reduced parental distress and fear of hypoglycemia (FOH) during nighttime in the context of CGM use.[15,22] Conversely, the literature also reports mixed effects on sleep and stress, suggesting that families may experience CGM differently.[17,23] Taken together, our findings indicate that while CGM use is generally linked to lower anxiety, simultaneous device demands and alarm burden may limit this benefit for some families.[17]

Among mothers using CGM, longer duration of use was associated with lower anxiety levels; however, caregiver burden was not related to duration. Qualitative studies have reported that, over time, families gain experience in device and alarm management, develop greater confidence in interpreting glucose trends, and integrate CGM more effectively into daily routines; these observations are consistent with the anxiety pattern we identified.[17,23] By

Table 1. Baseline sociodemographic and clinical characteristics by CGM use (CGM users n=65; non-users n=65)				
Variables		**CGM Users (n=65)**	**CGM non-users (n=65)**	**p-value**
Age (years), mean ± SD		11.81 (3.65)	11.51 (4.05)	0.648
Gender, n (%)	Female	28 (43.1)	36 (55.4)	0.219
	Male	37 (56.9)	29 (44.6)	
Schooling Status, n (%)	Not attending	7 (10.8)	10 (15.4)	0.830
	Primary school	15 (23.1)	15 (23.1)	
	Middle school	27 (41.5)	23 (35.4)	
	High school	16 (24.6)	17 (26.2)	
Presence of Chronic Illness, n (%)	None	48 (73.8)	54 (83.1)	0.431
	Thyroid disorder	6 (9.2)	2 (3.1)	
	Celiac disease	6 (9.2)	4 (6.2)	
	Other	5 (7.7)	5 (7.7)	
Family Structure	Nuclear Family	50 (76.9)	49 (75.4)	0.845
	Extended Family	7 (10.8)	6 (9.2)	
	Divorced Parents	7 (10.8)	9 (13.8)	
Diabetes duration (years), median (IQR)		2.94 (1.87-6.64)	2.96 (1.83-5.99)	0.419
Recent HbA1c (%), mean ± SD		7.57 (0.97)	8.20 (1.47)	**0.004**
Pre-study HbA1c (%), mean ± SD		7.83 (0.84)	8.18 (1.47)	0.099
Change in HbA1c (%), median (IQR)		0.2 (0.1-0.4)	-0.1 (-0.1-0)	**<0.001**
Duration of CGM use (months), mean ± SD		3.82 (1.02)	-	NA
Maternal age (years), mean ± SD		39.81 (6.66)	38.55 (5.8)	0.259
Maternal education, n (%)	Primary School	15 (23.1)	28 (43.1)	0.076
	Middle School	9 (13.8)	10 (15.4)	
	High school	24 (36.9)	16 (24.6)	
	University	17 (26.2)	11 (16.9)	
Maternal employment status, n (%)	Employed	19 (29.2)	16 (24.6)	0.693
	Unemployed	46 (70.8)	49 (75.4)	
Paternal age (years), mean ± SD		43.52 (6.07)	43.22 (5.56)	0.765
Paternal education, n (%)	Primary School	11 (16.9)	26 (40)	**0.002**
	Middle School	11 (16.9)	15 (23.1)	
	High school	16 (24.6)	14 (21.5)	
	University	27 (41.5)	10 (15.4)	
Paternal employment status, n (%)	Employed	57 (87.7)	60 (92.3)	0.560
	Unemployed	8 (12.3)	5 (7.7)	
Family income status, n (%)	Income < expenses	26 (40)	31 (47.7)	0.628
	Income = expenses	33 (50.8)	28 (43.1)	
	Income > expenses	6 (9.2)	5 (7.7)	

CGM: continuous glucose monitoring; HbA1c: glycated hemoglobin; IQR: interquartile range; SD: standard deviation.
Data are presented as mean ± SD, median (IQR), or n (%). p-values were calculated using independent samples t-test, Mann–Whitney U test, or chi-square test, as appropriate. The duration of CGM use is applicable only for CGM users. ΔHbA1c = initial − most recent; positive values indicate improvement

Table 2. Comparison of caregiver burden and anxiety scores between groups			
	CGM Users (n=65)	**CGM non-users (n=65)**	**p-value**
Caregiver burden total score (ZBI), mean ± SD	37.19 (10.21)	44.61 (14.05)	**0.001**
State anxiety score (STAI-S), mean ± SD	36.46 (7.69)	42.15 (6.5)	**<0.001**
Trait anxiety score (STAI-T), mean ± SD	40.26 (5.69)	49.59 (6.49)	**<0.001**

ZBI: Zarit Burden Interview; STAI-S: State-Trait Anxiety Inventory – State; STAI-T: State-Trait Anxiety Inventory – Trait.
Data are presented as mean ± SD. p-values were calculated using independent samples t-test.

Table 3. Correlation between CGM duration and maternal outcomes among CGM users		
	n	**CGM duration**
STAI-S	65	ρ=-0.388; p=0.0017
STAI-T	65	ρ=-0.676; p <0.0001
ZBI	65	ρ=-0.084; p=0.511

STAI-S: State-Trait Anxiety Inventory – State; STAI-T: State-Trait Anxiety Inventory – Trait; ZBI: Zarit Burden Interview. Values are two-tailed Spearman rho (ρ) with p-values. Negative coefficients indicate lower scores with longer CGM use. Analyses restricted to CGM users only. CGM duration expressed in months. The correlation results support the multivariable regression findings.

Table 4. Multivariable linear regression analysis of the association between CGM duration and maternal outcomes (CGM users only)						
	Regression Coefficients					
	β	**SE**	**t**	**p**	**95% CI for β**	
					Lower Bound	**Upper Bound**
STAI-T	-4.06	0.58	-6.98	<0.001	-5.2	-2.92
STAI-S	-3.78	0.96	-3.92	<0.001	-5.67	-1.89
ZBI	-0.38	1.42	-0.27	0.788	-3.17	2.42

STAI-S: State-Trait Anxiety Inventory – State; STAI-T: State-Trait Anxiety Inventory – Trait; ZBI: Zarit Burden Interview. β = unstandardized regression coefficient; SE = standard error; CI = confidence interval. Models adjusted for maternal age, maternal education, maternal employment status, family income proxy, child age, diabetes duration, and ΔHbA1c. CGM duration in months; CGM users only (complete-case n = 65). Adjusted R^2: STAI-T 0.473; STAI-S 0.183; ZBI 0.000.

Table 5. Multivariable linear regression analysis of the association between CGM use (yes vs no) and maternal outcomes (All participants)						
	Regression Coefficients					
	β	**SE**	**t**	**p**	**95% CI for β**	
					Lower Bound	**Upper Bound**
STAI-T	-8.8	1.42	-6.21	<0.001	-11.58	-6.02
STAI-S	-6.54	1.63	-4.02	<0.001	-9.73	-3.35
ZBI	-6.11	2.65	-2.30	0.022	-11.31	-0.91

STAI-S: State-Trait Anxiety Inventory – State; STAI-T: State-Trait Anxiety Inventory – Trait; ZBI: Zarit Burden Interview. β = unstandardized regression coefficient; SE = standard error; CI = confidence interval. Predictor: CGM use (yes vs no). Models adjusted for maternal age, maternal education, maternal employment status, family income proxy, paternal education, child age, sex, diabetes duration, and ΔHbA1c. Complete-case sample n = 130 per outcome. Adjusted R^2: STAI-T 0.348; STAI-S 0.134; ZBI 0.170. P-values reported in decimal format.

contrast, caregiver burden largely stems from broader and relatively stable demands (e.g., nighttime responsibilities, periods of illness, cumulative caregiving tasks). It is therefore less likely to change duration. This pattern underscores the multifactorial nature of caregiver burden and suggests that the psychosocial impact of CGM may differ across families.[19,24] Similarly, recent studies emphasize that caregiver burden is shaped by sociodemographic and clinical factors and persists as a multidimensional experience.[25,26]

Real-time glucose data and alarms may reduce uncertainty and enhance perceived control, thereby mitigating fear

of hypoglycemia (FOH) and nighttime hypervigilance; this framework aligns with models of uncertainty in illness and stress–coping.[7,8,14] Qualitative and quantitative findings suggest that CGM can reduce nighttime checks and FOH in some families, improve sleep quality, and strengthen feelings of safety.[15-17] However, alarm burden, constant data visibility, and practical challenges of sensor use may fragment sleep and increase stress for other families; such countervailing effects may explain heterogeneity across and within study samples.[17,23] Particularly in families with young children, daily life may evolve into a persistent state of vigilance, which may not be fully alleviated even under technological monitoring.[9]

In our sample, although children using CGM had lower current HbA1c values and more pronounced ΔHbA1c improvements, these glycemic indicators did not independently account for maternal anxiety or caregiver burden in multivariable models. This finding suggests that caregiver well-being is not determined solely by metabolic averages. While prior research has reported associations between parental diabetes distress and children's HbA1c, our results imply that maternal anxiety and burden may persist even when glycemic control improves.[3] Moreover, HbA1c, as a 2–3 month average, may be insufficient to capture shorter-term psychosocial fluctuations, highlighting the need for time-sensitive CGM metrics and momentary assessments.[27] Within this framework, psychosocial processes such as fear of hypoglycemia, perceived control, and coping/resilience may play a more direct role in shaping maternal outcomes than HbA1c alone.[28] Therefore, outcomes in T1D should not be limited to clinical markers alone; the psychosocial effects of CGM on families and its broader impacts on the health system should also be considered.[18]

These findings carry practical implications for diabetes care. Although CGM use was associated with lower maternal anxiety, benefits varied across families, underscoring the need for individualized counselling. Routine CGM implementation should therefore include discussion of caregiver expectations, alarm settings, and integration into daily routines. Recent studies from Türkiye report lower CGM uptake among low-income families and indicate that caregiver burden varies with parental sociodemographic and family characteristics.[21,29] Addressing these psychosocial dimensions may help maximize the benefits of CGM while minimizing stressors. In addition, family-centered empowerment interventions have been shown to reduce short-term caregiver burden and improve children's HbA1c, and may complement counselling.[30]

Our study has several strengths: maternal anxiety (STAI-S/T) and caregiver burden (ZBI) were assessed with validated instruments; analyses used adjusted models with prespecified covariates and checked assumptions; we demonstrated a duration-sensitive pattern linking longer CGM use to lower anxiety; device-related heterogeneity was minimized by the use of a single CGM system across users (FreeStyle Libre 2); and data were collected in a real-world outpatient setting with an a priori power calculation. Together, these features strengthen the robustness and clinical relevance of the findings.

Nevertheless, our study has limitations. Its cross-sectional design precludes causal inference and may be susceptible to selection effects. CGM exposure was relatively short and range-restricted (mean 3.8 months), which is likely insufficient to drive major changes in psychological states. Glycemic data were limited to two HbA1c time points, without time-sensitive CGM metrics or sleep/stress measures. Psychosocial outcomes relied on self-report (without structured psychiatric interviews). The single-center, technologically homogeneous sample may limit generalizability; despite adjustment for prespecified covariates, residual confounding and minor bias from complete-case analyses remain possible. These limitations underscore the need for multicenter studies with longer follow-up that incorporate time-sensitive CGM metrics and sleep/stress assessments.

In conclusion, in this single-center, comparative cross-sectional study, CGM use was associated with lower maternal anxiety and caregiver burden among mothers of children with type 1 diabetes; anxiety showed an inverse association with duration of CGM use, whereas HbA1c and ΔHbA1c did not independently account for these psychosocial outcomes. These findings suggest that processes beyond glycemic averages—such as uncertainty, alarm management, and day-to-day caregiving demands—may shape maternal well-being. In clinical practice, CGM counselling may be most effective when tailored to family preferences and supported by guidance on alarm settings and integration into daily routines. Nevertheless, given the cross-sectional design and relatively brief CGM exposure, the results are not causal. Multicenter studies with longer follow-up that incorporate time-sensitive CGM metrics and sleep/stress assessments are needed to clarify temporal dynamics and mechanisms.

Ethical approval

This study has been approved by the Muğla Sıtkı Koçman University Clinical Research Ethics Committee (approval date 10.01.2025, number 2025/12). Written informed consent was obtained from the participants.

Author contribution

The authors declare contribution to the paper as follows: Study conception and design: GCY, MDŞ; Data collection: GCY, MDŞ; Analysis and interpretation of results: GCY, MDŞ; Draft manuscript preparation: GCY. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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