MEDICA

(International Medical Scientific Journal)
Vol.8, No.7, July 2026, pp. 599 – 607
ISSN 2622-660X (Online), ISSN 2622-6596 (Print)
https://doi.org/10.53770/medica.v8i7.1149

Psychological Coping and Diabetes Distress in Adolescents with Type 1 Diabetes Mellitus: A Systematic Review

Ajeng Gustiani[1]✉, Siti Yuyun Rahayu Fitri[1], Taty Hernawati[2]

[1] Department of Paediatrics, Faculty of Nursing, Universitas Padjadjaran, Bandung City, West Java, Indonesia
[2] Department of Mental Health Nursing, Faculty of Nursing, Universitas Padjadjaran, Bandung City, West Java, Indonesia

Article Info

Article History:
Received:
09 June 2026
Revised:
01 July 2026
Accepted:
23 July 2026
Published:
30 July 2026

Keywords:
Adolescents
Diabetes Distress
Psychological Coping
Resilience
Type 1 Diabetes Mellitus

Citation:
Gustiani, A., Fitri, S.Y.R. & Hernawati, T. (2026). Psychological coping and diabetes distress in adolescents with type 1 diabetes mellitus: a systematic review. *MEDICA (International Medical Scientific Journal)*, 8(7), 599–607. https://doi.org/10.53770/medica.v8i7.1149

Abstract

Adolescents with Type 1 Diabetes Mellitus (T1DM) face continuous self-management demands that may contribute to diabetes distress and affect psychological well-being. Evidence on coping strategies in this population remains fragmented. This review aims to synthesize coping strategies, diabetes distress, and psychosocial factors among adolescents with T1DM. This systematic review followed PRISMA 2020 guidelines, with 822 records identified, 353 duplicates removed, 469 records screened, 198 full-text articles assessed, and 11 studies included in the final synthesis. The studies used cross-sectional, cohort, randomized controlled trial, and quasi-experimental designs involving adolescents and young adults with T1DM. Data were synthesized narratively, and study quality was assessed using the Joanna Briggs Institute (JBI) tools. Findings suggest that adaptive coping strategies such as problem solving, emotional regulation, acceptance, and social support may be associated with lower diabetes distress and better psychosocial adjustment. Maladaptive coping such as avoidance and denial may be associated with higher distress and poorer self-management. Psychosocial support from family and peers appears to facilitate adaptive coping, while limited support may increase vulnerability to distress. These findings highlight the importance of integrating coping-focused and psychosocial interventions in supporting psychological adaptation among adolescents with T1DM.

Corresponding Author:
✉ Ajeng Gustiani
Department of Paediatrics, Faculty of Nursing, Universitas Padjadjaran, Bandung City, West Java, Indonesia
Email: ajeng24007@mail.unpad.ac.id

1. INTRODUCTION

Type 1 Diabetes Mellitus (T1DM) is a chronic autoimmune disease characterized by the destruction of pancreatic β-cells, resulting in inadequate insulin production and subsequent hyperglycemia (Katsarou et al., 2017). T1DM is one of the most common chronic diseases among children and adolescents, with a global prevalence that has continued to increase over the past decades. The International Diabetes Federation (IDF) reported that more than 1.5 million children and adolescents worldwide live with T1DM, with an annual incidence increase of approximately 3–4% (Chiang et al., 2018). In adolescents, T1DM management is not limited to insulin therapy, but also involves glucose monitoring, dietary regulation, physical activity, and daily behavioral adjustments to maintain metabolic control (Yi-Frazier et al., 2024). This complexity makes T1DM not merely a medical condition, but also a chronic experience that may affect adolescents' psychological well-being, school activities, social relationships, and quality of life (Luo et al., 2024).

Adolescence is a developmental period characterized by identity formation, increasing independence, emotional changes, and a strong need for peer acceptance. Adolescents with T1DM must undergo lifelong insulin therapy, regularly monitor blood glucose levels, maintain dietary adherence, and adjust physical activity to achieve optimal glycemic control. The responsibility of carrying out diabetes care routines in everyday life may create specific psychological pressure, particularly when adolescents feel different from their peers or experience barriers to participating freely in social activities (Luo et al., 2024). Several studies have shown that adolescents with T1DM are more vulnerable to psychological problems, including anxiety, emotional stress, social isolation, and reduced quality of life compared with adolescents without chronic illness (Chen et al., 2025; Malkawi et al., 2025). These conditions may increase psychological burden because adolescents must reconcile the demands of a chronic disease with developmental needs related to autonomy, social relationships, and group acceptance (Luo et al., 2024; Straton et al., 2024).

One form of psychological burden commonly found among adolescents with T1DM is diabetes distress, defined as emotional strain arising from living with diabetes and the continuous demands of self-management. Diabetes distress includes feelings of being overwhelmed by treatment demands, concerns about complications, frustration with glycemic control, and emotional exhaustion in performing daily care tasks (Hagger et al., 2016). Diabetes distress differs from general depression because it specifically refers to the emotional burden directly related to diabetes management, including worries about complications, fatigue from ongoing treatment, and frustration when glycemic targets are difficult to achieve (Damilano et al., 2025). Study has shown that high levels of diabetes distress are associated with poorer self-management adherence, worse glycemic control, and increased HbA1c levels among adolescents with T1DM (Straton et al., 2024). In addition, diabetes distress has been linked to lower quality of life, impaired psychological well-being, and increased risk of mental health problems such as anxiety and depression (Efthymiadis et al., 2022; Liu et al., 2025).

The experience of diabetes distress in adolescents cannot be separated from the ways in which they respond to disease-related stress through coping strategies (Straton et al., 2024). Coping refers to cognitive and behavioral processes used by individuals to manage situations perceived as stressful or exceeding their available resources, including in the context of chronic illnesses such as diabetes (Bombaci et al., 2024). In adolescents with T1DM, coping strategies may include engagement coping, such as problem solving, acceptance, cognitive restructuring, and seeking social support, as well as disengagement coping, such as denial, behavioral disengagement, and avoidance of diabetes care tasks

(Martín-Ávila et al., 2025; Straton et al., 2024). Active engagement-oriented coping has been reported to be associated with better glycemic and psychosocial outcomes, whereas avoidant coping is associated with poorer outcomes among adolescents with T1DM who experience diabetes distress (Straton et al., 2024). These findings suggest that coping is an important psychological factor that may influence adolescents' adaptation to the demands of living with T1DM (Verma et al., 2025).

Beyond individual coping, the social context also plays an important role in adolescents' experience of distress related to T1DM (Luo et al., 2024). Peer relationships and family support may serve as a source of emotional support that helps adolescents maintain psychological well-being, particularly during a developmental stage in which social acceptance is highly meaningful (Chen et al., 2025). Nevertheless, adolescents with T1DM often report feeling different from their peers because of the need to monitor blood glucose, use insulin, or limit certain activities related to diabetes management (Azar et al., 2024). Longitudinal research has shown that peer stress can predict diabetes distress and quality of life among adolescents with T1DM (Luo et al., 2024). Positive social support may also strengthen the use of adaptive coping and serve as a protective factor against the psychological impact of diabetes distress (Bombaci et al., 2024). These findings indicate that distress among adolescents with T1DM is shaped not only by medical burden, but also by psychological capacity and social support in facing the demands of chronic illness (Luo et al., 2024; Straton et al., 2024).

Although coping strategies, diabetes distress, and psychosocial factors have been widely examined in adolescents with Type 1 Diabetes Mellitus, the available evidence remains fragmented and tends to treat these constructs as separate domains rather than interconnected processes. Conduah et al. (2025) synthesized coping across chronic illnesses, including diabetes, and emphasized its multidimensional and context-dependent nature. However, their synthesis was not specifically focused on adolescents with Type 1 Diabetes Mellitus, limiting its relevance to developmental and psychosocial characteristics unique to this population (Conduah et al., 2025). In addition, Jaser et al. (2017) demonstrated that coping plays an important mediating role between stress and psychological outcomes in adolescents with T1DM, yet the proposed framework remains partial as it does not fully integrate psychosocial determinants and diabetes distress within a unified model (Jaser et al., 2018). In this context, this review integrates psychological coping strategies, diabetes distress, and psychosocial determinants within a unified conceptual synthesis focused on adolescents with Type 1 Diabetes Mellitus. The synthesis addresses a fragmented evidence base in which these constructs have typically been examined in isolation. In doing so, this review provides a structured interpretation of their interrelationships that has not been previously synthesized in a systematic manner.

This systematic review aims to synthesize evidence on psychological coping strategies in adolescents with Type 1 Diabetes Mellitus, to analyze their relationship with diabetes distress, and to identify psychosocial factors influencing these processes. The review focuses on psychological adaptation in adolescents with T1DM by integrating coping strategies, diabetes distress, and psychosocial determinants within a unified analytical framework.

2. METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) guidelines to ensure transparency and reproducibility. The primary aim of this review was to identify, select, and synthesize scientific evidence related to psychological coping strategies in adolescents with Type 1 Diabetes Mellitus (T1DM), as well as to analyze their relationship

with diabetes distress and the psychosocial factors influencing this condition. Psychological adaptation in this review is conceptualized as the interaction between coping strategies, diabetes distress, and psychosocial factors among adolescents with T1DM.

The population of interest was adolescents included in this review individuls with Type 1 Diabetes Mellitus (T1DM) aged 10–24 years. Adolescent was defined based on the World Health Organization (WHO) classification for ages 10–19 years with an extension to 24 years to accommodate the emerging adulthood phase, which reflects the ongoing transition from pediatric to adult care in chronic disease management.

The research question was structured using the PICO framework. The population (P) consisted of adolescents with T1DM aged 10–24 years, the exposure (I/E) included psychological coping strategies such as problem-focused, emotion-focused, and avoidance coping, and the outcomes (O) included diabetes distress, psychological distress, and psychosocial functioning. A comparator (C) was not applied as this review synthesized observational and interventional studies.

The inclusion criteria comprised empirical studies involving adolescents with T1DM that explicitly examined psychological coping, diabetes distress, or related psychosocial aspects. Eligible study designs included cross-sectional, cohort, randomized controlled trials (RCTs), and quasi-experimental studies. Studies that did not meet the predefined population criteria, did not report outcomes related to coping or diabetes distress, and non-empirical publications such as editorials, commentaries, and conference abstracts without complete data were excluded from the analysis.

Psychological coping in this review is described as cognitive and behavioral efforts employed by individuals with Type 1 Diabetes Mellitus to handle stress related to disease management (Biggs et al., 2017; Lazarus & Folkman, 1984). Diabetes distress is characterized as an emotional burden arising from the continuous demands of managing diabetes in daily life (García-Poblet et al., 2025; Hagger et al., 2016). Psychosocial factors are conceptualized as environmental and interpersonal elements that influence diabetes management processes, including support from family, peer relationships, and overall emotional and social functioning (Liu et al., 2025; Luo et al., 2024).

A comprehensive literature search was conducted across five major databases, namely PubMed, Scopus, ScienceDirect, SAGE Journals, and EBSCOhost. The search strategy was developed using a combination of controlled vocabulary and free-text keywords tailored to each database. The keywords used included “Type 1 Diabetes Mellitus,” “adolescent OR teenager OR youth,” “coping OR coping strategies OR psychological adaptation,” and “diabetes distress OR emotional distress,” using the Boolean operators “AND” and “OR” to combine search terms. The search was limited to publications from 2016 to 2026 and restricted to English-language articles to ensure relevance and currency of evidence. The final database search was conducted on 22 June 2026. The full search strings for each database are provided in Appendix 1.

All records retrieved from the database search were imported into a reference manager for duplicate removal using combination of automated reference manager tools and manual verivication to ensure accurate deduplication across databases. After deduplication, records were screened based on titles and abstracts according to predefined inclusion criteria. Studies that were not relevant to the population, psychological variables, or study design were excluded at this stage. Eligible studies proceeded to full-text screening for detailed assessment. Articles that were unavailable in full text or inaccessible were excluded due to limitations in methodological evaluation and data extraction. Reasons for exclusion included irrelevant population, absence of coping or diabetes distress outcomes, inappropriate study design, and lack of full-text availability.

The selection process was conducted independently, and disagreements were resolved through discussion until consensus was reached. The study selection process followed PRISMA guidelines, and all stages of screening were documented in the PRISMA flow diagram, including numbers of records excluded at each stage.

Data extraction was conducted using a standardized form developed by the researchers to capture key information from each study, including author, country, study design, participant characteristics, age, study setting, measurement instruments, and main outcomes related to coping and diabetes distress. A methodological quality assessment was then performed using the Joanna Briggs Institute (JBI) Critical Appraisal Tools appropriate for each study design to evaluate the validity and strength of the evidence. This assessment was conducted independently by two reviewers, and disagreements were resolved through discussion. The appraisal results were not used as a basis for exclusion but rather to inform interpretation of the strength of evidence during synthesis. Data were analyzed using a narrative synthesis approach due to heterogeneity in study designs and variability in outcomes. The findings were grouped based on coping strategies, the relationship between coping and diabetes distress, and psychosocial factors influencing these conditions among adolescents with T1DM.

This review was not registered in PROSPERO because it was conducted as an exploratory evidence synthesis with iterative refinement of the search strategy and eligibility criteria during the initial scoping phase. However, all procedures followed PRISMA 2020 guidelines to ensure transparency and methodological rigor. During manuscript preparation, artificial intelligence–based tools were used to assist with language editing and readability improvement. However, all scientific content, data interpretation, and methodological decisions remain the sole responsibility of the authors.

3. RESULTS AND DISCUSSION

A total of 11 studies met the inclusion criteria and were analyzed in this systematic review. The included studies encompassed various research designs, including randomized controlled trials (RCTs), cross-sectional, cohort or longitudinal, and quasi-experimental intervention studies. Overall, all studies focused on adolescents with Type 1 Diabetes Mellitus (T1DM), with ages ranges extending from early adolescence to young adulthood. The primary topics examined included psychological coping, diabetes distress, self-management behaviors, resilience, psychological well-being, and psychosocial adjustment. Findings across these studies indicated that adaptive coping strategies, psychosocial support, and interventions aimed at enhancing psychological capacities were generally associated with lower levels of diabetes distress. Conversely, maladaptive coping, persistent distress, and low engagement in diabetes management were linked to suboptimal psychosocial and clinical outcomes.

A total of 822 records were identified from five databases, including PubMed, Scopus, ScienceDirect, SAGE Journals, and EBSCOhost. After removing 353 duplicate records using automated reference management tools and manual verification, 469 records were screened based on titles and abstracts. Of these, 271 records were excluded due to irrelevant population, absence of psychological coping or diabetes distress outcomes, and non-empirical study designs. A total 198 records proceeded to full-text retrieval. Thirty-four reports were not retrieved due to unavailability of full-text access. A total of 164 full-text articles were assessed for eligibility, of which 153 were excluded based on predefined inclusion criteria. Ultimately, 11 studies met all eligibility criteria and were included in this systematic review.

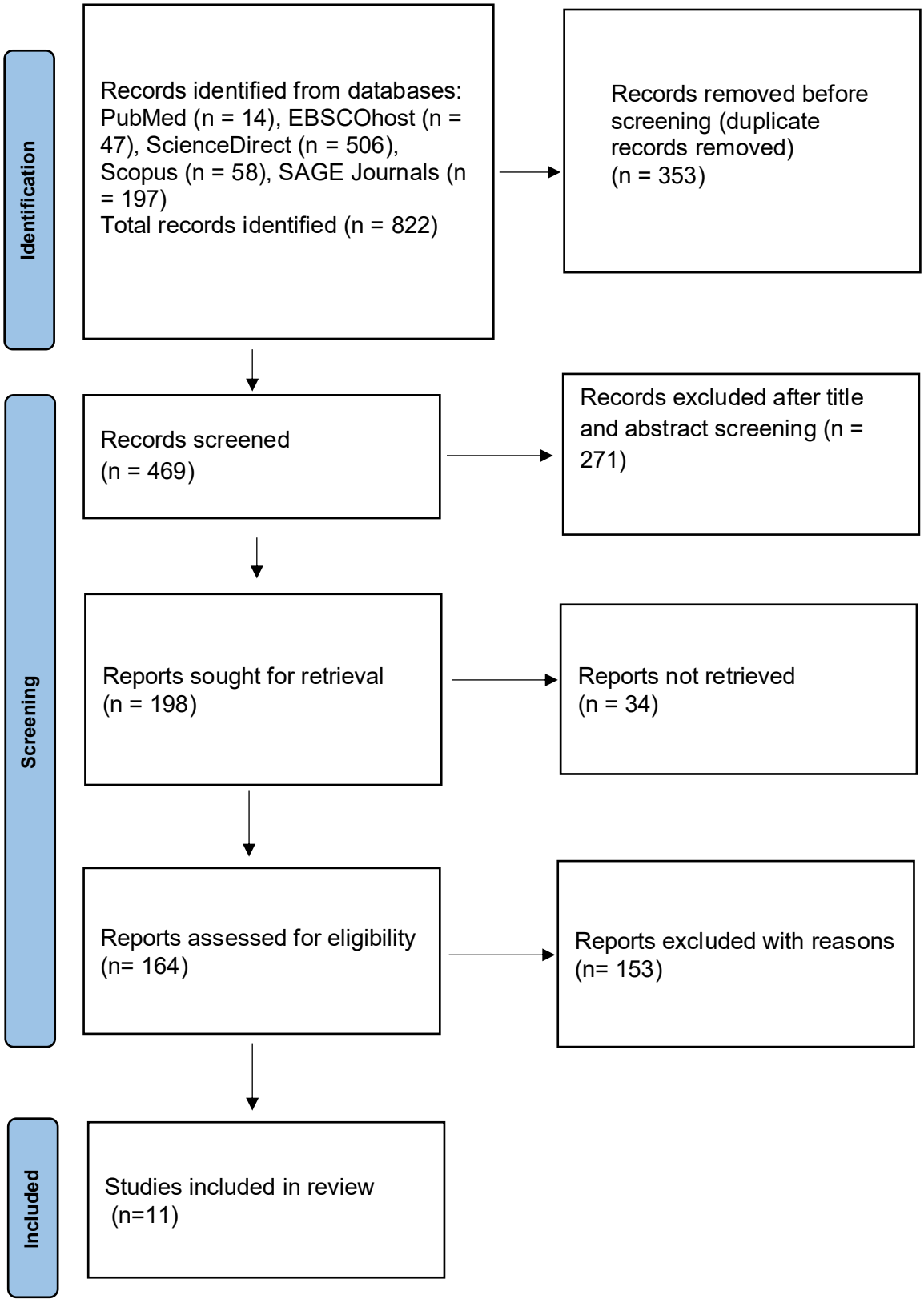

Figure 1. PRISMA flow diagram of article selection.

Table 1. Boolean search strategy across databases.

Database	Search String
PubMed	(((((diabetes mellitus, type 1[MeSH Terms]) OR (type 1 diabetes mellitus)) OR (T1DM)) AND ((((("adolescent"[MeSH Terms]) OR (adolescent)) OR (teenager)) OR (youth))) AND (((((coping) OR ("coping strategies")) OR (resilience)) OR ("psychological adaptation")) OR ("psychosocial adaptation"))) AND ((((("diabetes distress") OR ("diabetes-related distress")) OR ("psychological distress")) OR ("emotional distress"))
Scopus	("type 1 diabetes" OR T1DM) AND (adolescent OR teenager OR youth) AND (coping OR "coping strategies" OR resilience OR "psychological adaptation") AND ("diabetes distress" OR "diabetes-related distress" OR "emotional distress")
ScienceDirect	"type 1 diabetes" AND adolescent AND (coping OR resilience OR adaptation) AND (distress OR "emotional distress")
SAGE Journals	"type 1 diabetes" AND adolescent AND coping AND distress
EBSCOHost	(("Type 1 Diabetes Mellitus" OR T1DM)) AND (adolescent or teenager or youth or young person) AND ((coping OR "coping strategies" OR resilience OR adaptation)) AND (("diabetes distress" OR "emotional distress"))

Table 2. Quality appraisal using JBI criteria.

Authors	Design	JBI Score	Quality Appraisal
(Albright et al., 2024)	Cross-sectional	76.9%	High
(Hanberger et al., 2021a)	Cross-sectional	75%	High
(Zhou et al., 2023)	Cross-sectional	100%	High
(Weissberg-Benchell et al., 2020)	RCT	76.9%	High
(LeStourgeon et al., 2023)	RCT	69.2%	Moderate-High
(Yi-Frazier et al., 2024)	RCT	76.9%	High
(Humiston et al., 2024)	RCT	53.8%	Moderate
(Rodríguez-Rubio et al., 2025)	Quasi-experiment	88.9%	High
(Wentzell et al., 2025)	Cohort	100%	High
(Jaser et al., 2025)	RCT	76.9%	High
(Hood et al., 2018)	RCT	76.9%	High

The quality appraisal results indicated that most studies included in this review demonstrated generally good methodological quality based on assessment using the JBI Critical Appraisal Tools according to each study design. The RCTs generally demonstrated strengths in intervention design, outcome relevance, and clarity of measurement, although some articles still had limitations in reporting blinding procedures, allocation processes, or sample size. Observational studies, including cross-sectional and cohort studies, were also considered appropriate for synthesis because their populations, variables, and outcomes were aligned with the focus of this review. Overall, the included

studies were methodologically adequate to support the synthesis of evidence on coping strategies, diabetes distress, and psychosocial factors among adolescents with T1DM.

Table 1. Characteristic study.

Authors	Country	Design	Participants	Age	Setting	Outcome Measures	Main Findings
(Albright et al., 2024)	USA	Cross-sectional	n = 150	13 –18	Pediatric clinics	Diabetes distress, coping questionnaires	Adaptive coping associated with lower diabetes distress and better psychosocial adjustment
(Hanberger et al., 2021a)	Sweden	Cross-sectional	n = 197	7–18	Pediatric clinics	Pain, fear, coping, distress scales	Maladaptive coping associated with higher diabetes distress; females reported higher distress
(Zhou et al., 2023)	China	Cross-sectional	n = 185	10 –24	Two diabetes centers, Nanjing	PAID-5, DEPS-R, DSTAR-Teen, SRF-S	Self-regulatory fatigue mediated the effect of diabetes distress on disordered eating; resilience moderated
(Weissberg-Benchell et al., 2020)	USA	RCT	n = 264	14 –18	Multi-center pediatric clinics	PAID-T, CDI, SCI-R, HbA1c	STePS intervention reduced diabetes distress and depressive symptoms at 3-year follow-up
(LeStourgeon et al., 2023)	USA	RCT	n = 60	13 –17	Outpatient pediatric clinic	Positive affect, coping, HbA1c	SMS-based positive psychology intervention improved positive affect, adaptive

							coping, and diabetes-related psychosocial outcomes.
(Yi-Frazier et al., 2024)	USA	RCT	n = 172	13 –18	Pediatric clinics	PAID-T, DSTAR, DSMQ, HbA1c	PRISM intervention improved diabetes distress and self-management behaviors at 12 months
(Humiston et al., 2024)	USA	RCT	n = 25	13 -17	Pediatric diabetes clinics (remote/self-guided intervention)	Feasibility, acceptability, mindfulness participation, diabetes-related stress/distress indicators, HbA1c (self-reported)	Self-led mindfulness intervention was feasible and acceptable for adolescents with T1DM. Participants reported positive experiences with stress management and emotional coping; however, attrition was substantial and efficacy outcomes were exploratory.
(Rodríguez-Rubio et al., 2025)	Spain	Quasi-experiment	n=19	12–18	Online sessions + caregiver	Psychological adaptation, coping	10VIDA program improved coping, well-being, and emotional adjustment
(Wentzell et al., 2025)	USA	Cohort	n=301	13–17	Two pediatric clinics	PAID-Peds, HbA1c	Persistent or rising diabetes distress associated with higher

							A1C; females disproportionately affected
(Jaser et al., 2025)	USA	RCT	n=198	13–17	Pediatric clinics	PAID-T, PANAS, RSQ, HbA1c	Positive psychology intervention reduced diabetes distress; high engagement, HbA1c stable
(Hood et al., 2018)	USA	RCT	n=264	14–18	Pediatric clinics	PAID-T, resilience measures	Resilience-based intervention reduced diabetes distress and improved psychosocial functioning

The study characteristics showed variation in research design, sample size, setting, measurement instruments, and reported outcomes. Most studies were conducted in pediatric clinics or diabetes care centers, involving adolescents with T1DM whose age ranges and clinical characteristics varied across studies. The most frequently examined outcomes included diabetes distress, coping strategies, resilience, self-management behaviors, HbA1c, and psychological well-being.

Across the included studies, psychological coping strategies, diabetes distress, and psychosocial factors consistently appear as interrelated components shaping how adolescents with Type 1 Diabetes Mellitus (T1DM) adapt psychologically to long-term disease management. Rather than functioning as isolated constructs, these elements seem to interact dynamically within the daily experiences of adolescents living with a chronic condition. The coping responses identified across studies are consistent with the transactional model of stress and coping proposed by Lazarus and Folkman. From this perspective, coping is closely linked to cognitive appraisal process through which adolescents evaluate diabetes-related demands. When diabetes management is perceived as something that can be managed or controlled, adolescents are more likely to engage in problem-focused coping strategies such as planning, structured self-care, and problem-solving behaviors. These patterns were repeatedly observed in several included studies (Albright et al., 2024; Jaser et al., 2025; Yi-Frazier et al., 2024; Zhou et al., 2023).

Emotion-focused coping strategies were also frequently observed, particularly among adolescents experiencing higher emotional burden. These responses include emotional regulation, acceptance, and reliance on social support systems (Hanberger et al., 2021; Jaser et al., 2025; LeStourgeon et al., 2023). Avoidance coping, characterized by denial and disengagement from diabetes self-management tasks, was more commonly observed when diabetes was appraised as overwhelming or difficult to manage (Hanberger et al., 2021b; Rodríguez-Rubio et al., 2025). These findings indicate that

coping responses are shaped by cognitive appraisal processes and represent adaptive responses to perceived disease demands rather than fixed behavioral traits.

Diabetes distress reflects a persistent emotional burden associated with the continuous demands of diabetes self-management. This includes frustration with treatment routines, concerns about long-term complications, and emotional fatigue related to daily disease monitoring. Across studies, diabetes distress emerged as a sustained psychological strain that interferes with both emotional well-being and self-management capacity (Hanberger et al., 2021; Hood et al., 2018; LeStourgeon et al., 2023; Zhou et al., 2023). Higher diabetes distress was predominantly observed among adolescents with reduced engagement in self-management behaviors and increased reliance on maladaptive coping strategies (Jaser et al., 2025; Rodríguez-Rubio et al., 2025; Yi-Frazier et al., 2024).

The relationship between coping strategies and diabetes distress can be explained through the transactional stress and coping framework proposed by Lazarus and Folkman (1984), which highlights cognitive appraisal as a central mechanism in determining coping responses (Lazarus & Folkman, 1984). This framework has been further developed in contemporary literature that emphasizes the dynamic and multidimensional nature of coping processes (Biggs et al., 2017). Adolescents who perceive diabetes management as manageable tend to engage in adaptive coping strategies, which are associated with lower emotional burden and more optimal psychological adjustment. In contrast, appraisal of diabetes demands as overwhelming or exceeding available resources is more likely to be followed by reliance on emotion-focused or avoidance-oriented coping, contributing to increased psychological distress and reduced adaptive capacity. This interpretation is consistent with evidence from the included studies, which collectively indicate that adaptive coping is associated with lower diabetes distress, whereas maladaptive coping corresponds with poorer psychological and behavioral outcomes (Albright et al., 2024; Jaser et al., 2025; Rodríguez-Rubio et al., 2025; Yi-Frazier et al., 2024).

This relationship is further supported by external evidence. Maladaptive behavioral patterns and poorer health outcomes in adolescents with Type 1 Diabetes Mellitus are associated with psychological distress (García-Poblet et al., 2025). Similarly, interventions targeting coping skills and emotional regulation can reduce psychological burden and improve overall adjustment (Małachowska et al., 2023). Collectively, these findings indicate that coping processes play a central role in shaping the level of diabetes-related distress experienced by adolescents.

Beyond individual coping processes, psychosocial conditions contribute meaningfully to psychological outcomes in adolescents with Type 1 Diabetes Mellitus. Family support, peer relationships, and broader social functioning provide external resources that influence emotional appraisal processes and coping responses in adolescents with Type 1 Diabetes Mellitus. In contexts where support systems are stable and accessible, adolescents are more likely to engage in adaptive coping responses and report lower emotional burden. Coping and diabetes distress are closely linked in a bidirectional pattern, where increased distress can undermine coping capacity and further intensify psychological strain over time.

Psychological adaptation in adolescents with Type 1 Diabetes Mellitus reflects continous interaction between cognitive appraisal, coping strategies, diabetes distress, and psychosocial context resources that jointly influence emotional and behavioral adjustment.

4. CONCLUSION

This systematic review demonstrates that psychological adaptation in adolescents with Type 1 Diabetes Mellitus is shaped by the continuous interaction between cognitive appraisal, coping strategies, diabetes distress, and psychosocial context within the framework of Lazarus and Folkman's transactional model of stress and coping. Coping processes play a central role in regulating emotional responses to diabetes management, while diabetes distress reflects a persistent psychological burden influenced by coping patterns and social support. These findings highlight the importance of integrating psychosocial care into clinical diabetes management, particularly by strengthening adaptive coping strategies and addressing diabetes-related distress to improve psychological outcomes and self-management in adolescents. This review contributes to the existing literature by integrating fragmented evidence into a coherent framework of psychological adaptation in adolescents with T1DM. Future research should further explore longitudinal and mechanistic pathways to clarify dynamic relationships between coping, diabetes distress, and psychosocial factors.

CONFLICT OF INTEREST

The authors declare that they have no competing interests.

AUTHOR CONTRIBUTIONS

Ajeng Gustiani conceived and designed the study, conducted the literature search, screened and selected the eligible studies, extracted and synthesized the data, performed the quality appraisal, and prepared the original manuscript draft. Siti Yuyun Rahayu Fitri contributed to the study design, supervised the review process, critically reviewed the methodology and interpretation of the findings, and revised the manuscript. Taty Hernawati provided methodological guidance, supervised the research process, critically reviewed the manuscript, and contributed to the interpretation of the findings. All authors read, approved, and agreed to be accountable for the final version of the manuscript.

ACKNOWLEDGEMENT

The authors would like to thank the Faculty of Nursing, Universitas Padjadjaran, for providing academic support and access to scientific references that contributed to the completion of this systematic review.

FUNDING

This research received no external funding.

DECLARATION OF ARTIFICIAL INTELLIGENCE USE

Artificial intelligence (AI)-assisted technology was not used in the conception, literature search, study selection, data extraction, data analysis, interpretation of findings, or scientific decision-making for this manuscript. AI was used solely to improve the language, grammar, readability, and overall clarity of the manuscript. The authors take full responsibility for the content of this manuscript.

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