

Review of diabetes education intervention targeting parent/caregiver of children with type 1 diabetes



Review

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Received: 27 November 2024; Accepted: 18 December 2024; Published: 20 March 2026

Abstract: **Objective:** This review aimed to evaluate existing evidence of educational interventions targeted at parents and caregivers of children with type 1 diabetes (T1D) to improve diabetes management outcomes.

Methods: A general review was conducted with primary caregivers of children younger than 18 with T1D as the population of interest. Journal searches were performed using the CINAHL, EBSCO, PubMed, Scopus, Science Direct, and Google Scholar, databases for publications between 2017 and 2024, with full text in English.

Results: A total of 26 studies were included in the review. Nine of these studies focused on various educational interventions, both technology-based and non-technology-based. By contrast, 17 studies examined the impact of these interventions on caregiver outcomes, such as treatment adherence and glycemic control in children with T1D. So, the following research questions guided this review: (1) What is the effectiveness of diabetes education interventions on glycemic control in children with T1D? (2) How do caregiver knowledge and self-efficacy affect diabetes management outcomes?

Conclusions: Diabetes interventions highlight the vital role of empowering caregivers of children with T1D with knowledge, skills, and support to improve and enhance their adherence to treatment, knowledge, and self-efficacy that ultimately contribute to better glycemic control of children as reflected by their HbA1c levels. This review highlights the importance of diabetes education interventions for caregivers of children with T1D. The evidence indicates that such interventions can improve caregiver knowledge, self-efficacy, and glycemic control in children. However, variability in outcomes suggests that further research is needed to identify the most effective educational strategies.

Keywords: caregivers • children • diabetes management • glycemic control • intervention • structured education • Type 1 diabetes mellitus

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1. Introduction

Type 1 diabetes (T1D) in children is defined as an autoimmune and heterogeneous disorder that starts with pancreatic β -cell obliteration and ends with absolute deficiency or insufficiency of endogenous insulin, as well as latent autoimmune diabetes in adults.^{1,2}

Fluctuating scores of blood sugar are the main battle experienced by children with T1D and their parents.³ Due to the physiological nature of children, their growth and development are sensitive to lack of insulin; any events like inappropriate insulin doses, dehydration,

How to cite this article: Hasonah O, Alshraideh JA, Arabiat DH. Review of diabetes education intervention targeting parent/caregiver of children with type 1 diabetes. *Front Nurs*. 2026;1:15–24.

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severe infection, and others can be the leading cause of hyperglycemia that may develop into diabetic ketoacidosis (DKA).⁴ T1D imposes enduring exogenous insulin injections,⁵ and follows a new day-to-day management plan, including frequent monitoring of blood sugar, physical activity, and a healthy diet to achieve the optimal level of glycemic control.⁶ Also, insulin types require arduous commitment of children with T1D and their parents to match the insulin dose to the amount and type of dietary intake,⁴ counting carbohydrates with multiple insulin injections that interfere with fear of needles and self-injection, and three to four-time blood sugar monitoring³ to achieve the optimal and targeted score of HbA1C.³

Managing diabetes is a complex and time-consuming task that requires continuous commitment throughout a child's lifetime.³ There is no escape, even during holidays or breaks.⁷ Caregivers play a critical role in managing type 1 diabetes in children, yet they face substantial challenges, including managing complex treatment regimens, ensuring proper insulin administration, and monitoring blood glucose levels. These challenges often contribute to caregivers' stress, affecting the health of both the child and the caregiver.⁷

Primary caregivers of children with T1D bear the primary responsibility for managing their children and play a crucial role in ensuring effective adherence to diabetes treatment.⁸ This review focuses on caregivers of children with type 1 diabetes, as they are the primary figures responsible for diabetes management. Empowering caregivers with adequate knowledge and skills is crucial for improving glycemic control in children with T1D. Insights gleaned from both qualitative and quantitative studies in the systematic review on caregivers' perspectives in raising a child with T1D have highlighted significant concerns regarding the current needs of the parents of those children.³ A range of interventions targeting caregivers and families who are raising children with T1D are effective in improving diabetes management with different outcomes. Several studies have evaluated diabetes education interventions; however, there remains a lack of synthesized evidence focusing specifically on the caregiver's role in managing children's diabetes. These concerns encompass various aspects, including knowledge about T1D, insulin injection administration, hypoglycemia management, frequent glucose testing, dietary considerations, adherence to sick-day guidelines, and achievement of the targeted HbA1c score.^{3,9}

Diabetes educational interventions and training form the cornerstone of diabetes management for caregivers of children with T1D. This review aims to bridge this gap by synthesizing findings from recent studies to highlight effective educational interventions for caregivers of children with T1D. As shown, caregivers who are

empowered and equipped with diabetes knowledge and skills, exhibit enhanced capabilities in preventing and managing acute complications.^{8,10,11} This review evaluated a range of diabetes management interventions targeting caregivers and families raising children with T1D. The findings demonstrated the significant positive impact of educational programs on glycemic control, caregiver knowledge, and self-efficacy. These interventions included family centered empowerment models, diabetes self-management education (DSME), structured education programs, and technology-enhanced methods. The purpose of this review is to evaluate the existing evidence regarding educational intervention targeted by caregivers and families raising a child with T1D on diabetes management outcomes.

2. Methods

This review was conducted to evaluate the existing literature on educational interventions for caregivers of children with T1D and their impact on diabetes management outcomes. The phenomenon of interest in this review was the role of diabetes education in improving the self-management skills of caregivers, and consequently, the glycemic control and overall health outcomes for children with T1D.

Inclusion criteria for the review encompassed quantitative and qualitative research articles published in English between 2017 and 2024. The study population in this review consisted of primary caregivers of children diagnosed with T1D; specifically those with children aged 0–17 years were selected to capture the full spectrum of developmental stages in children with T1D. While there are developmental differences within this range, we aimed to include studies that address the educational needs of both younger children and adolescents, recognizing that diabetes management strategies may differ at various developmental stages. Studies were required to focus on primary caregivers of children with T1D and address structured diabetes management programs, with metabolic control (e.g., glycemic control or HbA1c levels) measured as the primary or secondary outcome. Editorials, opinion pieces, case reports, and review articles were excluded from the review. The decision to restrict the literature to the past 7 years was based on the increasing body of research addressing diabetes management interventions for caregivers and the evolving nature of diabetes care.

Four major electronic databases were searched to retrieve the relevant literature: PubMed, CINAHL via EBSCO, Scopus, and Science Direct. The following keywords were employed in the search process: "type 1 diabetes mellitus," "caregivers," "education," "self-efficacy," "glycemic control," "diabetes management,"

“adherence,” and “structured health education,” with the use of Boolean operators “AND,” “OR,” and MeSH terms. The search was conducted between 2017 and 2024. The initial search resulted in a total of 1948 articles across the selected databases: PubMed (284 articles), EBSCO (27 articles), Scopus (2 articles), Science Direct (129 articles), and Google Scholar (1500 articles). After removing duplicates and screening the titles and abstracts for relevance, 1432 articles were excluded. A further 480 studies were discarded after full-text review due to non-relevance or failure to meet inclusion criteria. The final selection consisted of 36 studies, which were included in the review. The quality of the included studies was assessed using the Joanna Briggs Institute’s Critical Appraisal Tool.¹² This tool was used to evaluate the methodological rigor of the

studies, and each study was scored based on its design and reporting quality.

3. Results

Key details from the included studies were summarized and tabulated under the following headings: authors, publication year, study design, sample size, population characteristics, intervention type, and main findings. These details were compiled into a literature review matrix (Table 1), which provided a clear overview of the study characteristics and outcomes. The following research questions guided this review: (1) What is the effectiveness of diabetes education interventions on glycemic control in children with T1D? (2) How do caregiver knowledge and self-efficacy affect diabetes management outcomes?

| Author(s) | Publication year | Country | Design | Population & sample size | Main results |
|-------------------------------------|------------------|--------------------------|------------------------------------|---|--|
| EISayed et al. ¹ | 2023 | USA | Guideline/Standard | General population | Updated standards for diabetes care, focusing on diagnostic criteria and new treatment options. |
| Syed ² | 2022 | USA | Review | General population | Reviewed various management strategies for type 1 diabetes; emphasized the role of early intervention and education. |
| Holt et al. ⁵ | 2021 | International | Consensus report | Adults with type 1 diabetes | Provided consensus guidelines for the management of type 1 diabetes in adults, emphasizing continuous glucose monitoring and advanced therapies. |
| Lohan et al. ⁷ | 2017 | International | Cross-sectional | Parents of children with type 1 diabetes | Studied parental factors affecting child diabetes management behaviors, highlighting the role of parental stress and education. |
| Elsayed et al. ¹⁰ | 2020 | Egypt | Cross-sectional | Diabetic children | Assessed insulin injection issues and their impact on children with diabetes, identifying challenges in insulin administration and adherence. |
| Isprantari et al. ¹¹ | 2023 | International | Review | Children and adolescents with type 1 diabetes | Reviewed family centered interventions and their impact on diabetes management; emphasized the importance of family involvement in care. |
| Abraham et al. ¹³ | 2023 | Southwest Ethiopia | Cross-sectional | Children and adolescents with type 1 diabetes | Examined glycemic control and associated factors; identified factors influencing glycemic control in this population. |
| Alassaf et al. ¹⁴ | 2023 | Jordan | Cross-sectional | 10–17 years old with type 1 diabetes | Found prevalence of depression in children with type 1 diabetes; highlighted the need for mental health screening. |
| Al-Shorman et al. ¹⁵ | 2023 | Jordan | Experimental (Educational program) | Parents and adolescents with type 1 diabetes | Studied the effect of an educational program on self-efficacy; showed improvement in self-efficacy and disease management. |
| Dayal et al. ¹⁶ | 2022 | India | Cross-sectional | Children with type 1 diabetes | Analyzed factors affecting glycemic control, finding socio-economic status and access to healthcare as significant contributors |
| DiMeglio et al. ¹⁷ | 2018 | Multiple (International) | Consensus guidelines | Children, adolescents, young adults with diabetes | Provided clinical practice guidelines on glycemic control targets and glucose monitoring for children and young adults with type 1 diabetes. |
| Elhawry et al. ¹⁸ | 2021 | Egypt | Cross-sectional | Caregivers of children with type 1 diabetes | Studied the impact of caregiver health education on glycemic control and self-management; found improved outcomes in educated caregiver |
| Fiallo-Scharer et al. ¹⁹ | 2019 | USA | Experimental (family centered) | Children with type 1 diabetes | Explored the impact of family centered tailoring on diabetes self-management; showed improved adherence to treatment. |

(Continued)

Table 1. Continued

| Author(s) | Publication year | Country | Design | Population & sample size | Main results |
|-------------------------------------|------------------|---------------|-----------------------------------|--|---|
| Fung et al. ²⁰ | 2024 | USA | Randomized controlled trial | Parents of children with type 1 diabetes | Found that coaching programs for parents led to improvements in diabetes management and child glycemic control. |
| Girma and Berhane ²¹ | 2023 | Ethiopia | Cross-sectional | Caregivers of children with type 1 diabetes | Assessed caregivers' knowledge and practices related to diabetic care, identifying gaps in knowledge and practices affecting child health outcomes. |
| Grau-Del Valle et al. ²² | 2022 | Spain | Psychometric study | type 1 diabetic patients | Developed and validated a questionnaire to measure adherence to treatment, showing high reliability and validity for assessing adherence. |
| Hama Salih ²³ | 2019 | Iraq | Cross-sectional | Children with type 1 diabetes | Studied factors affecting glycemic control in children in Iraq, identifying family history and healthcare access as significant predictors. |
| Hawkes et al. ²⁴ | 2019 | International | Educational program | Children with newly diagnosed type 1 diabetes | Found that a structured 1-year education program improved early glycemic control in children with newly diagnosed type 1 diabetes. |
| Habtayohans et al. ²⁵ | 2023 | Ethiopia | Cross-sectional | Children with type 1 diabetes | Examined factors associated with poor glycemic control in children with type 1 diabetes, highlighting diet and physical activity as key contributors. |
| Khallaf et al. ²⁶ | 2022 | Egypt | Cross-sectional | Mothers and children with type 1 diabetes | Examined maternal knowledge, coping strategies, and their impact on glycemic control in children with type 1 diabetes. |
| Mauri et al. ²⁷ | 2021 | Italy | Experimental (Structured program) | Children and adolescents with type 1 diabetes | Assessed a therapeutic education program and its efficacy on diabetes management in children and adolescents, showing positive impacts on self-care. |
| McLarty et al. ²⁸ | 2021 | Tanzania | Cross-sectional | Children, adolescents, young adults with type 1 diabetes | Studied glycemic control and acute complications in a Tanzanian cohort, finding suboptimal control and high complication rates. |

Table 1. Study characteristics and outcomes.

3.1. Impact of interventions on glycemic control and caregivers outcomes

The evidence of an interventional study by Rostami-nasab et al.⁴ supported that such programs based on caregiver empowerment interventions were effective in reducing the caregivers of children with T1D burdens.⁴ In addition, it showed statistically significant children's HbA1c scores improvement ($P < 0.0001$), and high caregiver self-efficacy where they became more independent to meet their childcare needs.⁴ Al-Shorman et al.¹⁵ revealed a significant positive enhancement in self-efficacy scores for caregivers of young children with T1D after providing such structured diabetes educational training in Jordan.¹⁵ Additionally, the results from a study examining the impact of DSME training on caregivers of children aged 6–12 years with diabetes indicated a notable enhancement in their children's HbA1c scores.¹⁸ The percentage of children achieving good glycemic control demonstrated an increase from 57.6% before the intervention to 62.3% and 70.8% at 3 months and 6 months post-intervention, respectively.¹⁸ The

pediatric educational diabetes (PED) project, aligned with global guidelines, stands as a beacon of success for diabetes management training.²⁷ This project is designed to cover four areas that are involved: building new skills for self-monitoring of blood glucose; flexibility in adjustment to insulin therapy; therapy management regarding diet and exercise; and coping with emotions related to the disease. The evidence by Mauri et al.²⁷ revealed positive outcome impacts among Italian children aged 9–14 years and their parents; as their A1C scores reduced at $P < 0.001$, it increased parent's diabetes knowledge at $P < 0.001$, and appropriate behaviors for the self-care skills management of diabetes increased to $P < 0.005$.²⁷ Regarding well-being, children also showed their acceptance of T1D with a high sense of adapting ability.²⁷ Furthermore, the result by Nassar et al.²⁹ revealed high statistically significant differences in the levels of mothers' knowledge on pre- and posttests of mother's adherence education program at $P < 0.001$, and they underscored the significant role of knowledge in fostering adherence and insulin injection practice among mothers of children with T1D.

Fiallo-Scharer et al.¹⁹ in their randomized study of parents and children with T1D (8–16 years) suggest to receive either TSM intervention based on individualized needs, barriers, and diabetes visits, or usual care, to evaluate the intervention's impact on HbA1c score and quality of life (QoL) during 9 months and 1 year. It revealed that the mean score of HbA1c at 1-year post intervention reduced by 0.059% per month for the interventional group in children aged 13–16, than for those receiving usual care ($P = 0.02$).¹⁹ Moreover, the QoL for parents of children in the same age group increased by 0.61 points per month more than those receiving usual care ($P = 0.03$).¹⁹ Diabetes treatment adherence is considered a healthy habit that grew early in caregivers and their children with T1D, and continued into adolescence and adulthood; thus, it is the solid foundation for better adherence.⁷ Nassar et al.²⁹ reported a highly significant increase in mothers' adherence on the post-test compared with the pretest ($P < 0.001$) following participation in a structured diabetes management training in pre- and post-tests at $P < 0.001$. In addition, they concluded that caregivers who were equipped with diabetes knowledge through structured diabetes management training were effective in achieving glycemic control for their children with T1D.²⁹ Hawkes, Willi, and Murphy²⁴ reported that the implementation structured education-led program on children with T1D (5–16) is associated with significant improvement in glycemic control only among children with T1D aged 5–12 years of age, whose parents played an active role in their care than in adolescents who received standard diabetes care at 6 months after diagnosis (6.7% vs. 7.1%, $P < 0.001$), 12 months after diagnosis (7.3% vs. 7.8%, $P < 0.001$), and 18 months after diagnosis (7.6% vs. 7.9%, $P = 0.01$). Unfortunately, there was no improvement at 24 months (7.8% vs. 8%, $P = 0.14$) after diagnosis.²⁴ Contrastingly, in the results of a randomized controlled study by Fung et al.²⁰ after the implementation of an educational coaching intervention program for parents of children with T1D, there was no significant improvement in parent and child QoL, parent diabetes treatment adherence score, parents conflict, and no glycemic control improvement.

3.2. The impact of caregivers knowledge on diabetes management outcomes

Caregivers' knowledge serves as a pivotal benchmark for assessing the effectiveness of diabetes management, acting as the foundation for successful diabetes care and glycemic control.^{26,29} Active caregiver participation emerges as a critical component of successful diabetes care.³ Furthermore, Girma and Berhane²¹ have reported that caregivers who attend the educational sessions, and have good a knowledge level, showed

statistically significant associations with their diabetic care practices (blood glucose monitoring, rotation injection site to prevent lipodystrophy and other practices). It was seen to be 9.4 times in caregiver attending diabetes education (AOR = 9.48; 95% confidence interval [CI]: 1.17–79.66) and 2.04 times in caregivers who had good diabetes knowledge (AOR = 2.04; 95% CI: 1.03–4.04) than their counterparts.²¹ In addition, Elsayed et al.¹⁰ revealed that there was a statistically significant correlation between caregiver diabetes knowledge and the correct practice of insulin injection techniques for their children ($P < 0.001$).¹⁰ Once again, ongoing caregivers' learning and awareness about diabetes management led to better adherence tasks, were more liable to follow instructions for diet, rotated injection sites, exercise, and self-blood glucose monitoring provided by their child's treatment team.^{22,29}

As notable in cross-sectional studies, children whose primary caregivers are mothers exhibit better glycaemic control than those with other guardian caregivers. Abraham, Tilahun, and Gelana¹³ found that children without mothers as primary caregivers were 4.4–6 times more likely to experience poor glycaemic control than children with mothers as primary caregivers.¹⁴ Also, minimal involvement of caregivers in insulin injection administration for their children resulted in poor glycaemic control 5.4 times versus children who had optimal caregiver involvement ($P = 0.002$), and poor glycaemic control was 4.4 times in children with poor blood glucose monitoring adherence as compared with children who had good adherence ($P = 0.026$).¹⁴ Moreover, Niba et al.³⁰ demonstrated a significant association between maximal caregiver involvement and adherence in blood glucose monitoring for children with T1D and positive glycaemic control ($P < 0.001$) They also emphasize the crucial role of the primary caregiver in administering diabetes treatment and maintaining optimal metabolic control for a child with T1D.³⁰ The adherence to diabetes treatment is notably influenced by the knowledge and practices of primary caregivers.³¹

3.3. Predictors for better glycaemic control in children with T1D

Globally, T1D imposes financial burdens that are highly associated with non-compliance and settle for suboptimal treatment, parental stress enhancement, and family conflicts.³² This is because the patient is unable to meet the medical cost of medications, supplies (e.g., Glucocheck, test strips, syringes/pen needles and insulin vials/pen devices, and others), investigations, recurrent hospitalizations, and management of complications specifically nephropathy-related diabetes.³² On the other hand, families face exponentially indirect economic burdens such as transport costs and lifestyle adjustment

costs.³³ However, through the findings of a systematic review, there were additional costs related to the nutritional perspective of buying sugar-free/low-sugar food as reported in the studies conducted in Jamaica, Brazil, Egypt, Ghana, Iran, and the United States.³ Several studies have recognized socioeconomic status as one of the factors that influence T1D outcomes.³⁰

A cross-sectional result of the investigation of the predictors of glycemic control among children with T1D in Cameroon by Niba, Aulinger, and Mbacham³⁰ showed that children who lived in low to middle socioeconomic status exhibited poor glycemic control. These findings are in line with the results observed in Sudanese children.³⁴ In a cross-sectional study involving 231 children with T1D, conducted by Habteyohans et al.²⁵ the findings indicated that children with caregivers who were illiterate were four times more likely to exhibit poor glycemic control compared with those with caregivers possessing a secondary education. In addition, illiterate caregivers struggle to achieve and promote effective diabetes treatment, with impacts on the child's care, follow-up, and correct drug handling and delivery.²⁸

The educational level of caregivers plays a significant role in diabetes treatment adherence, as caregivers with lower educational attainment may face challenges in comprehending treatment recommendations.²⁵ Similarly, Taha et al.³⁴ reported consistent findings, identifying both financial constraints and caregiver illiteracy as potential factors contributing to poor glycemic control in children with T1D. Numerous studies have identified the age of children with T1D as a predictor of glycemic levels. However, the findings of a cross-sectional study involving 231 children and adolescents with T1D conducted by Habteyohans et al.²⁵ contradicted this trend. The study reported that preschool children were 81% less likely to have poor glycemic control compared with those aged between 10 years and 18 years.²⁵ This unexpected result is attributed to the active involvement and supervision of caregivers for their preschool-aged children. As children grow older, they become more independent, undergo physical and lifestyle changes, and may experience challenges in managing their diabetes,¹⁷ as well as due to hormonal effects and limitations in caregiver supervision of treatment in adolescents.¹⁷

Furthermore, Jordanian children spanning various developmental ages and diagnosed with T1D between 1 year and 18 years are exhibiting suboptimal glycemic control, accompanied by severe complications like recurrent DKA and hypoglycemia.³⁵ Predictors contributing to inadequate glycemic control in Jordanian children with T1D include age, with an older age associated with a decline in glycemic control, dietary non-compliance, and other contributing factors.¹⁴ These findings align

with the outcomes of a study conducted by Dayal et al.¹⁶ Regarding the gender of the children, the research indicated no notable differences in glycemic control between boys and girls. However, girls displayed higher HbA1c scores.¹⁶ Similarly, Hama Salih,²³ exploring factors linked to metabolic control, identified a significant relationship between children's age and glycemic control ($P = 0.005$). Conversely, there was no significant association found between glycemic control and gender, socioeconomic status, or the education level of caregivers ($P > 0.05$).²³ A significant association was seen between the number of scheduled visits to the healthcare provider and good glycemic control. Also, commitment to follow-up appointments promotes the needed adjustments of insulin regimens, and extra educational sessions for caregivers and children will be provided.²⁵ Another study found that more frequent visits to the diabetic clinic concerning providing the caregivers of children with adequate knowledge and skills adjustments resulted in improved glycemic control of children with T1D.¹³

4. Discussion

This review highlights the critical role of caregiver-focused diabetes education in improving diabetes management outcomes for children with T1D. Across various interventions, significant improvements were observed in glycemic control, caregiver knowledge, and self-efficacy. These findings underscore the importance of tailored, evidence-based programs addressing both the medical and psychosocial aspects of diabetes care. Structured interventions such as the PED project and DSME programs consistently demonstrated reductions in HbA1c levels and enhanced caregiver capabilities. The family centered empowerment model of Rostaminasab et al.⁴ also successfully improved caregivers' self-efficacy and reduced their burden, emphasizing the need for holistic educational approaches. Despite positive outcomes, the effectiveness of interventions varied; adolescents showed reduced benefits due to greater independence and hormonal changes, necessitating age-appropriate strategies. Financial constraints, caregiver illiteracy, and limited access to resources significantly hindered treatment adherence in low-resource settings.

Despite the positive outcomes observed in several studies affirming the efficacy of various diabetes educational programs for caregivers of children with T1D, there remains ongoing debate surrounding the effectiveness of certain interventions that have failed to improve diabetes management. These discussions center on caregiver knowledge levels, self-efficacy, adherence to diabetes treatment, and the subsequent impact on glycemic control in children. As highlighted earlier, optimal glycemic

control is crucial for shielding children with T1D from potential complications. To address the variability in training effectiveness, it is imperative to establish well-designed, regularly updated, and continuous training programs for multidisciplinary teams. The content of these programs should be tailored to the caregivers' cognitive abilities, and cost considerations must also be factored in. Furthermore, evaluating the effectiveness of diabetes treatment services serves as a gateway to uncover gaps and identify the necessary improvements for enhanced management and glycemic control in children with T1D. While this review highlights the benefits of diabetes education programs, it also recognizes the limitations of the studies reviewed, including small sample sizes, the reliance on self-reported data, and the lack of standardized intervention designs. These factors may limit the generalizability of the findings. Future research should focus on larger, more diverse populations, as well as standardizing intervention methods to assess their long-term effectiveness and impact on glycemic control.

To maximize effectiveness, diabetes education programs should be tailored to the developmental stages of children and the specific needs of caregivers, address socioeconomic barriers through policy interventions and accessible educational resources, and incorporate caregiver stress reduction and empowerment strategies. Further research is needed to evaluate the long-term impact of caregiver education on diabetes outcomes, particularly for adolescents. In addition, studies should explore scalable and cost-effective interventions suitable for low-resource settings. To sum up, caregiver-focused diabetes education is vital for improving outcomes in children with T1D. Tailored, supportive programs can enhance caregiver capabilities, improve glycemic control, and ultimately contribute to a better QoL for both caregivers and children.

5. Conclusions

This review evaluated the effectiveness of diabetes education interventions for caregivers of children with T1D, focusing on their impact on knowledge,

self-efficacy, and glycemic control outcomes. The findings revealed that well-structured diabetes education programs are crucial for enhancing caregivers' knowledge and skills, which significantly contribute to improved diabetes management and glycemic control for children with T1D. The studies included in this review demonstrated that caregiver empowerment, particularly through structured DSME and family centered approaches led to improved adherence to treatment regimens, better self-efficacy, and improved HbA1c levels in children. However, variability was noted in the effectiveness of these interventions, with some studies indicating more significant improvements in younger children compared with adolescents, suggesting that age and the level of caregiver involvement may influence intervention outcomes. The results underscore the importance of tailored diabetes education programs that address the unique needs of caregivers, providing them with the knowledge and tools required for effective management of their child's condition. Interventions should not only focus on disease management but also incorporate emotional and psychological support for caregivers, as well as strategies to reduce caregiver stress. To conclude, diabetes education interventions for caregivers are essential for improving the management of T1D in children. These interventions lead to enhanced caregiver knowledge and self-efficacy, which, in turn, result in better glycemic control and reduced complications.

Acknowledgments

The authors thank the editor and the anonymous reviewers.

Ethical approval

Ethical issues are not involved in this paper.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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