REVISTA BRASILEIRA DE MEDICINA DE FAMÍLIA E COMUNIDADE
RBMFC

www.rbmfc.org.br
ISSN 2179-7994

Research Article

Type 1 diabetes and mental health in children: a systematic review

Diabetes tipo 1 e saúde mental em crianças: uma revisão sistemática

Diabetes tipo 1 y salud mental en niños: una revisión sistemática

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Abstract

Introduction: Type 1 diabetes (DM1) is one of the main chronic diseases in childhood significantly impacting the lives and routines of caregivers and patients in a traumatic manner, serving as a major stressor. **Objective:** This systematic review aims to assess whether children with DM1 may exhibit a higher prevalence of symptoms or psychiatric disorders compared to their peers and whether the presence of these disorders leads to poorer diabetes control. **Methods:** This systematic review was conducted following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and was registered in the PROSPERO database for systematic reviews. The last search in databases was on May 11, 2023, resulting in 1910 articles selected on the basis of topic, keywords or abstract. Articles involving a population aged 0 to 12 years with type 1 diabetes from 2013 to 2023 were included, focusing on mental health. **Results:** Of the 1910 articles systematically selected, only 7 were chosen for analysis. Among these, 3 showed a significant association in mental health scores when comparing children with and without diabetes, while the others indicated a weak association. **Conclusions:** It appears that there is a relationship between the control of diabetes mellitus and mental health indicators, underscoring the importance of clinical monitoring and proper disease management for the quality of life of those with this condition. In the selected studies, the main limitation was the restricted number of participants and the assessment tools used.

Keywords: Diabetes mellitus type 1; Mental health; Child.

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E-mail: pietrocasa29@gmail.com
Funding:
No external funding.
Ethical approval:
Not applicable.
Informed consent form:
Not applicable.
Provenance:
Not commissioned.
Peer review:
External.
Received: 11/16/2023.
Approved: 02/12/2025.

How to cite: Casagrande PP, Gonçalves MEOA, Costa JZ, Lopes TQ. Type 1 diabetes and mental health in children: a systematic review. Rev Bras Med Fam Comunidade. 2025;20(47):4036. https://doi.org/10.5712/rbmfc20(47)4036

Resumo

Introdução: A diabetes mellitus do tipo 1 (DM1) é uma das principais doenças crônicas da infância e afeta a vida e a rotina de cuidadores e pacientes de modo traumático e pode ser vista como um estressor importante. **Objetivo:** Esta revisão sistemática almejou avaliar se crianças com DM1 podem ter maior presença de sintomas ou doenças psiquiátricas em relação aos pares e se a presença dessas doenças leva a um pior controle da diabetes. **Métodos:** Esta revisão sistemática foi realizada de acordo com as recomendações da Preferred Reports Items for Systematic Reviews and Meta-Analyses (PRISMA) e foi registrada no banco de dados PROSPERO para revisões sistemáticas. A última pesquisa nos bancos de dados foi no dia 11 de maio de 2023, resultando em 1910 artigos que foram selecionados por tópico, palavras-chave ou resumo. Foram incluídos artigos de 2013 a 2023 com população entre 0 e 12 anos com diabetes tipo 1 avaliadas em relação à saúde mental. **Resultados:** Dos 1.910 artigos selecionados sistematicamente, apenas 7 foram selecionados para análise. Destes, três mostraram associação significativa em pontuações de saúde mental comparando crianças com e sem diabetes, enquanto os outros mostraram fraca associação. **Conclusões:** Parece que há uma relação entre o controle do diabetes mellitus (DM) e os indicadores de saúde mental, ressaltando a importância do acompanhamento clínico e do manejo adequado da doença para a qualidade de vida dos portadores dessa condição. Nos trabalhos selecionados, a principal limitação foi o número restrito de participantes e os instrumentos avaliativos utilizados.

Palavras-chave: Diabetes mellitus tipo 1; Saúde mental; Criança.

Resumen

Introducción: La DM1 es una de las principales enfermedades crónicas en la infancia y afecta la vida y la rutina de cuidadores y pacientes de manera traumática, pudiendo ser vista como un importante factor estresante. **Objetivo:** Esta revisión sistemática tiene como objetivo evaluar si los niños con DM1 pueden tener una mayor presencia de síntomas o enfermedades psiquiátricas en comparación con sus pares, y si la presencia de estas enfermedades conduce a un peor control de la diabetes. **Métodos:** Esta revisión sistemática se realizó siguiendo las recomendaciones de Preferred Reports Items for Systematic Reviews and Meta-Analyses (PRISMA) y se registró en la base de datos PROSPERO para revisiones sistemáticas. La última búsqueda en las bases de datos se realizó el 11 de mayo de 2023, resultando en 1910 artículos que fueron seleccionados por tema, palabras clave o resumen. Se incluyeron artículos con población de 0 a 12 años con diabetes tipo 1 de 2013 a 2023 evaluada con relación a la salud mental. **Resultados:** De los 1910 artículos seleccionados sistemáticamente, solo se eligieron 7 para su análisis. De estos, 3 mostraron una asociación significativa en las puntuaciones de salud mental al comparar a niños con y sin diabetes, mientras que los demás mostraron una asociación débil. **Conclusiones:** Parece haber una relación entre el control de la diabetes mellitus y los indicadores de salud mental, destacando la importancia del seguimiento clínico y del manejo adecuado de la enfermedad para la calidad de vida de quienes tienen esta condición. En los trabajos seleccionados, la principal limitación fue el número reducido de participantes y los instrumentos de evaluación utilizados.

Palabras clave: Diabetes mellitus tipo 1; Salud mental; Niño.

INTRODUCTION

Type 1 diabetes mellitus (DM1) is a chronic, autoimmune condition characterized by insulin deficiency and apoptosis of pancreatic beta cells.[1,2] It is among the main chronic diseases of childhood, accounting for the majority of cases of diabetes in children under 10 years of age, regardless of ethnic group.[3,4] The diagnosis and treatment of DM1 affect caregivers and patients in a traumatic way, given that its first presentation is acute, and may even present as diabetic ketoacidosis in 25 to 40% of patients.[5,6] In addition, as treatment involves blood glucose control, physical activity control, routine visits to the health service, and administration of subcutaneous insulin, parents and caregivers may become overwhelmed, and children may experience treatment for the disease as a stressor, impairing control and maintenance of treatment goals.[3,6-8]

In view of the recent interest in children's mental health for public health,[9] as well as the influence of psychosocial factors on the health and disease process of chronic diseases, this systematic review aimed to assess whether children with DM1 may have a greater presence of psychiatric symptoms or illnesses in relation to healthy peers, which factors are related to these symptoms, what the consequences are for caregivers, and whether the presence of these illnesses leads to worse disease control compared to children with DM1 without the presence of mental disorders.

METHODS

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and registered in the PROSPERO database of systematic reviews under number CRD42023403848.

The research question for this systematic review was: “Do children with type 1 diabetes have a higher prevalence of psychiatric disorders compared to healthy children (without type 1 diabetes)?”

Inclusion criteria

Included were cohort, cross-sectional, case-control, randomized clinical trial and case series studies with more than three cases that addressed mental health in children aged 0 to 12 years with DM1. All articles in Portuguese and English related to the topic were included. All articles included had been published less than 10 years ago.

Exclusion criteria

Studies that focused on patients over 12 years of age and diseases other than DM1 were excluded. When the age range was pediatric (0 to 18 years), those that did not separate patients by age group were excluded.

Inappropriate study designs, such as: systematic reviews, books, non-academic research, reviews, abstracts, commentaries, policy statements, case reports with fewer than three cases, and content in languages other than English or Portuguese were also considered as exclusion criteria for articles retrieved from the databases. Finally, articles published more than 10 years ago were also excluded.

Sources of information

The database search was conducted on May 11, 2023. Studies were selected from five databases: PubMed (all fields; National Center for Biotechnology, Information, National Institutes of Health; Bethesda, MD, USA), Scopus (article title, abstract, keywords; Elsevier; Amsterdam, Netherlands), MEDLINE/Bireme (Virtual Health Library – VHL, title, abstract, subject; US National Library of Medicine, National Institutes of Health; Bethesda, MD, USA), Web of Science (article title, abstract, keywords; Thomson Reuters; New York, NY, USA); and EMBASE (article title, abstract, keywords; Elsevier; Amsterdam, Netherlands).

Literature search strategy

For document research, the selected descriptors were based on MeSH (Medical Subject Headings). The search key used by the authors in each of the databases mentioned is presented in Figure 1.

Study selection and data extraction

A total of 1,910 articles were found on the five selected platforms using the search keys above.

Databank	Search strategy
PubMed	((mental health) AND (children)) AND (type 1 diabetes mellitus) + publication date 10 years
Scopus	TITLE-ABS-KEY-AUTH(children AND mental health AND type 1 diabetes mellitus) AND PUBYEAR > 2012 AND PUBYEAR < 2024 AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (LANGUAGE,"English"))
Embase	('insulin dependent diabetes mellitus'/exp OR 'insulin dependent diabetes mellitus') AND ('mental health'/exp OR 'mental health') AND ('child'/exp OR child) AND 'article'/it AND (2013:py OR 2014:py OR 2015:py OR 2016:py OR 2017:py OR 2018:py OR 2019:py OR 2020:py OR 2021:py OR 2022:py OR 2023:py) AND ([child]/lim OR [infant]/lim OR [newborn]/lim OR [preschool]/lim OR [school]/lim)
MEDLINE	(mental health) AND (children) AND (type 1 diabetes mellitus) -> Filters applied Clear all database MEDLINE (remove) Language English (remove) Portuguese (remove)
Web of Science	((ALL=(mental health)) AND ALL=(type 1 diabetes)) AND ALL=(child) and 2013 or 2014 or 2015 or 2017 or 2022 or 2023 or 2021 or 2020 or 2019 or 2018 or 2016 (Years of publication) and Artigo (types of document) and English or Portuguese (languages)

Figure 1. Databases used and search strategy.

For selection, the existence of duplicate documents was initially checked using the “find duplicates” tool in the EndNote X9 software (Clarivate Analytics; Philadelphia, PA, USA; EndNote version X9 for Windows). In this step, 1,427 articles were eliminated. Duplicate articles that were not excluded by the platform tool were manually excluded, thus eliminating 23 more, leaving 414 articles after these two steps.

In the second step, the authors read the titles of the remaining articles and excluded those that did not fit the inclusion criteria, totaling the exclusion of 310 articles: 10 for being articles related to adults with DM1; 11 for being articles aimed at parents of children with DM1; 201 for being articles related to other diverse topics; 33 for being related to DM2; 27 for not addressing mental health; 24 because they addressed mental health, but not DM1; and 4 because they were excerpts from studies that did not meet the inclusion criteria, leaving 104 articles.

In the third step, the abstracts of the remaining articles were read, and 72 more articles that did not meet the inclusion criteria were eliminated, leaving 32 articles. Thirteen articles were excluded because of inadequate design, 11 because they were not related to the pediatric population, 13 because they were not related to mental health, 1 because it was related to DM2, and 34 because they addressed age groups other than those covered in the article.

In the final procedure, the remaining texts were read in full, and 25 more articles were eliminated: 7 for not addressing mental health, 11 because the children’s age was different from what was defined, 2 for inadequate study design, 1 for inadequate methodology and 4 because it was not possible to access them in full, leaving 7 articles. Finally, “citation tracking” was performed in the bibliographic references of the selected articles, but no more relevant articles were found, keeping the seven articles used in the study.

The relevant data were added to the knowledge matrix, which was used to organize and systematize the relevant information, using the Microsoft Excel spreadsheet Version 7.0.25 (Microsoft Corporation; Redmond, Washington, USA) for Windows 10. The process is illustrated in the flowchart in Figure 2.

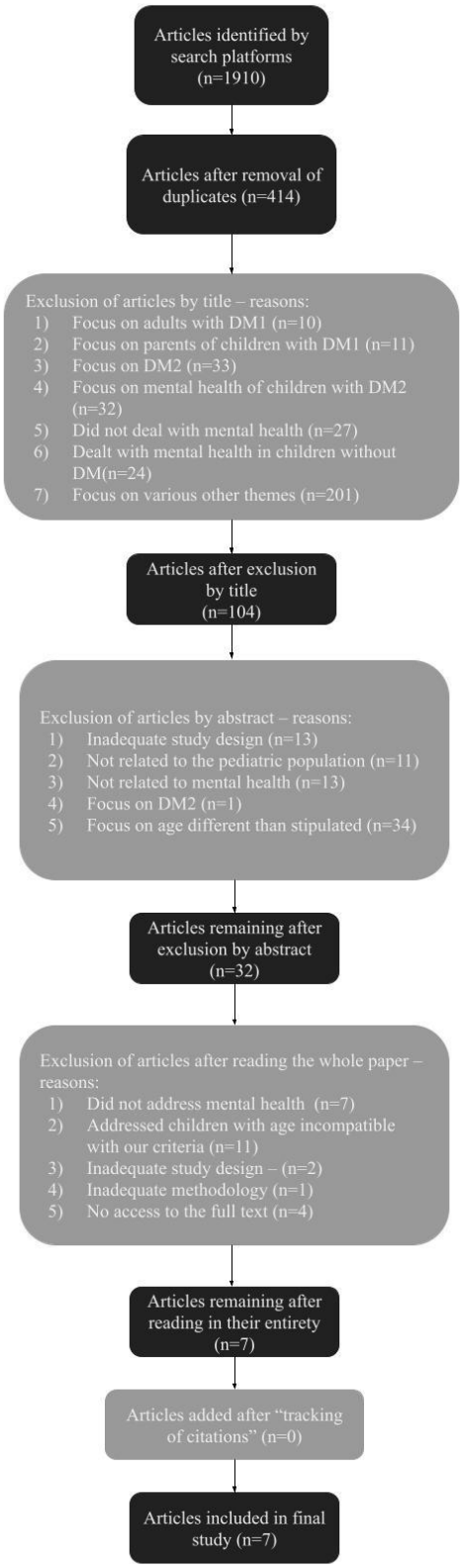

Figure 2. PRISMA flowchart for selection of articles.

Risk of bias

The articles were independently assessed by all authors for risk of bias. Any disagreement was resolved through discussion among the group in a synchronous video call meeting. The Joana Briggs Institute (JBI) risk of bias assessment checklists for cohorts, cross-sectional studies, case-control studies and case series were used for the analysis.

The assessment checklists have four possible answers: “Yes”, “No”, “Unclear” or “Not applicable”. When the question was not applicable, the criterion was not considered in the assessment, according to the JBI recommendations. Risk of bias was determined on the basis of number of positive responses in the assessment instrument. Therefore, it was possible to divide the articles into three groups: high (up to 49%), moderate (50 to 70%) and low (over 70%) risk of bias. Of the seven articles that were included because they met all the criteria, five demonstrated low risk of bias, and two, moderate risk. Therefore, no articles were excluded because of methodological failure.

RESULTS

Topics

Six topics were characterized for the presentation of the results of this study: characteristics of the included studies, average age of the children, diagnostic tools used, mental health changes, changes in glycemic control and alleged limitations. A summary of the results is presented in Figure 3.

Reference	Country	Year	Study	Patients	Age group	Mental health	Presence of DM1 improves, worsens or has no influence on mental health?	Glycemic control improves, worsens or has no influence on mental health?	Risk of bias	Statistical significance
Bahadur et al.[9]	Turkey	2021	Control	75	4 to 12 years	CSHQ/CBCL	No influence	Worsens	Low	5%
Farsani et al.[10]	Netherlands	2017	Cohort	925	0 to 18 years	Dispensation of psychiatric medications in health system	Worsens	Worsens	Low	5%
Hannonen et al.[12]	Finland	2015	Control	63	9 to 10 years	BASC	Worsens	No influence	Moderate	5%
Khan et al.[13]	Pakistan	2013	Cross-sectional	86	7 to 15 years	CDI	Worsens	Worsens	Low	5%
Kristensen et al.[14]	Denmark	2014	Cohort	788	8 to 17 years	BYI-Y/SDQ	No influence	Worsens	Low	5%
Murillo et.[8]	Spain	2017	Cohort	136	8 to 19 years	EQ-5D-Y KIDSCREEN	Worsens	Worsens	Low	5%
Zenlea et al.[15]	United States	2013	Cross-sectional	130	4 to 19 years	SDQ	No correlation	Worsens	Moderate	5%

Figure 3. Main characteristics of the studies included in the review.

Characteristics of included studies

The studies were conducted in different countries, four of which were European, two Asian and one American. Of the seven, three were cohort studies, two case-control studies and two cross-sectional studies. The case-control studies had an average of 69 patients; the cohorts, an average of 616; and the cross-sectional studies, 108.

Ages of children

Studies such as those by Farsani et al., Khan et al., Kristensen et al. and Murillo et al. had ages above the defined range but were maintained because they separated the results of children and adolescents. The rest of the studies remained within the age range of 0 to 12 years.

Diagnostic tools

Children's Sleep Habits Questionnaire (CSHQ), Child Behavior Checklist (CBCL), Behaviour Assessment for Children (BASC), Children's Depression Inventory (CDI), Beck Youth Inventory (BYI-I), Strengths and Difficulties Questionnaire (SDQ), EuroQol-5D (EQ5DY) and KIDSCREEN were the questionnaires used to assess mental health, applying them to both children and parents/guardians. Farsani et al., however, used the assessment of psychiatric drug dispensing in the health system. In addition, the studies by Bahadur et al. and Hannonen et al. assessed the mental health condition of parents using questionnaires such as the Likert Scale, Beck's Depression Inventory (BDI) and Pittsburgh Sleep Quality Index (PSQI).

Of the selected studies, five assessed mental health using behavioral tools (Bahadur et al., Hannonen et al., Kristensen et al., Murillo et al. and Zenlea), three assessed mental health using depression questionnaires (Farsani et al., Khan et al. and Kristensen et al.) and one assessed quality of life (Murillo et al.).

Changes in mental health in presence of DM1

Bahadur et al., Kristensen et al. and Zenlea et al. did not find a statistically significant association between the presence of DM1 and changes in mental health detected in questionnaires, both for behavior and depression. Even so, borderline or abnormal values were determined in older children and children outside the control group.

Murillo et al., Farsani et al. and Hannonen et al. found significant values for the comparison between children with DM1 and children without the diagnosis. Hannonen et al. found a higher risk of internalizing behavior in relation to children in the same age group; Farsani et al. found a greater number of psychiatric medications for the group with DM1, regardless of age group. For Murillo et al., advanced age, single-parent family structure and adherence to mental health therapy were statistically significant in the assessment of mental health.

According to Khan et al., depression was not present in the majority of children with DM1 evaluated, but in older children, with longer disease duration and lower socioeconomic status, scores more related to depression were detected within the CDI.

Changes in glycemic control

In the studies by Zenlea et al. and Bahadur et al., no correlations were found between glycemic control and mental health indicators. Murillo et al., Khan et al. and Farsani et al. did find an association between patients with poor control of DM1 and mental health problems. Similarly, Khan et al. and

Kristensen et al. saw that indicators of good control of DM1 were also associated with good mental health indicators. Furthermore, Murillo et al. points out that patients with recent disease also tend to have better glycemic control.

Hannonen et al. observed that patients with behavioral problems prior to the diagnosis of DM1 had worse metabolic control. These authors found no relationship between the psychosocial changes observed in prepuberty and poor glycemic control.

Alleged limitations

Of the seven selected studies (Bahadur et al.,[10] Farsani et al.,[11] Hannonen et al.,[12] Khan et al.,[13] Kristensen et al.,[14] Murillo et al.[15] and Zenlea et al.[16]), six used child mental health assessment tools based on self-report or caregiver report and are therefore a form of subjective measurement. In addition, six of these studies (all but Farsani et al.) used a small sample and are therefore not very representative of the population of children with DM1.

However, studies have limitations related to the tool used to identify or monitor children with DM1. Bahadur et al. used only Hb1Ac for glycemic control; Farsani et al. relied exclusively on insulin dispensing data.

DISCUSSION

DM1 is a disease that has a major impact on the lives and family dynamics of children around the world. The disease carries a great burden, as it requires recurrent monitoring several times a day, since the lack of control leads to life-threatening outcomes. These factors are enough to generate psychological distress in patients and caregivers, and this psychological distress can lead to non-treatment and progression of the disease, increasing the risk of acute and serious events related to hyperglycemia.

The presence of results with both statistical significance and borderline results, associating worse mental health assessments in patients with DM1 compared to patients of the same age group without the disease, helped to strengthen this link between the presence of DM1and a higher risk of affective or behavioral disorders. Regarding this correlation, Tejo-Henriquez et al.[17] pointed out that changes in habits and lifestyle, fear of complications and parents' concerns about the child's future negatively influenced the patient's environment and, consequently, their psychosocial health. Similarly, Chatterjee et al.[18] highlighted that anxiety, behavioral problems and depression are the most common psychiatric problems observed in children with DM1. Furthermore, these authors established a correlation between psychological stress in these children, the number of insulin injections per day and non-compliance with dietary and medication recommendations.

However, the inconclusiveness of some studies has shown that this association is still weak and questionable, given that mental health conditions are also related to family dynamics, lifestyle, socioeconomic status and age group. Studies such as that of Munkacsi et al.[19] also found no association between the presence of DM1 and worse scores on depression scales.

In addition, it is possible to see that worse mental health indicators are related to the lack of control of glycemic indexes, just as better glycemic control is also related to better indicators. The

variation in glycemic levels during the period of brain development leads to injury to nervous tissue, which in turn can lead to negative outcomes related to mental health.[20] With this in mind, neglect of treatment can be the cause of mental health conditions, as a result of brain injury, or psychological damage can affect patients' adherence to treatment, negatively affecting glycemic control. Accordingly, internalization and externalization problems become obstacles to the treatment of DM1 in children, since the presence of these problems is associated with both worse glycemic control and complications of the disease.[21]

In addition to the impacts on the child's life, Khemakhem et al., Ansari et al. and Capistrant et al.[22-24] also showed in their studies that the presence of DM1 in children also negatively influenced the mental health of their caregivers, with emphasis on symptoms of anxiety and psychological stress. This is mainly due to the loss of the prospect of a "normal life" for the child, the responsibility for controlling blood glucose levels, the costs of treatment and the fear related to the negative outcomes of the disease.[25] According to the same authors, such conditions can even lead caregivers to burnout.

The limitations of this review are related to the reliance on mental health and quality of life studies that, even when using established tools, depend on self-reporting by parents and children. In addition, because of the age range, few studies were able to meet the proposed inclusion criteria, as well as the analysis of glycemic control being limited to glycosylated hemoglobin alone, preventing an analysis of time on target or measures related to other clinical variables.

CONCLUSION

This article aims to investigate the association between DM1 and mental health in children. Although it is a topic of extreme clinical relevance, given the prevalence of the disease and its consequences for patients and their caregivers, only seven studies were found.

By analyzing the articles, it was possible to conclude that there is a relationship between the control of diabetes mellitus and mental health indicators, highlighting the importance of clinical monitoring and adequate management of the disease for the quality of life of those with this condition. In the selected studies, the main limitation was the limited number of participants, making it difficult to apply them to the target population.

Therefore, more studies are still needed to evaluate mental health indicators in the population of children with DM1. These studies will be important in guiding the clinical management of the disease, to provide greater well-being and better physical health for diabetic children and their families.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

PPC: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft. MEOAG: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Project administration,

Software, Writing – original draft. JZC: Data curation, Formal analysis, Investigation, Methodology, Software, Writing – original draft. TQL: Data curation, Formal analysis, Investigation, Methodology, Writing – original draft.

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