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RELATIONSHIP BETWEEN ANXIETY AND GLYCATED HEMOGLOBIN IN ADOLESCENTS WITH TYPE 1 DIABETES

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This study examines the correlations between physiological and psychological parameters in teenagers with type 1 diabetes. Notably, increased HbA1c levels, indicating poorer glycemic control, are significantly associated with heightened general and school-related anxiety. Such anxiety could stem from the daily pressures of disease management and fear of acute complications, particularly in school settings. Older teenagers and those with longer disease duration exhibit less frustration related to success, potentially due to improved coping mechanisms and disease familiarity. Moreover, higher HbA1c is linked to perceived lower physiological robustness. The study also finds that age inversely correlates with anxiety about teacher relationships, suggesting maturation reduces such concerns. These findings underscore the complex interplay between diabetes management, age, and psychological wellbeing in adolescents.

Keywords: *type 1 diabetes (T1D); teenagers, anxiety, glycated hemoglobin (HbA1c), anxiety, disease duration.*

RELAȚIA DINTRE ANXIETATE ȘI HEMOGLOBINA GLICATĂ LA ADOLESCENȚII CU DIABET DE TIP 1

Studiul analizează corelația dintre parametrii fiziologici și starea psihologică la adolescenți cu diabet tip 1. Nivelele crescute de HbA1c, care indică un control glicemic slab, corelează cu anxietatea generală și cea școlară. Această anxietate poate proveni din presiunea gestionării bolii și frica de complicații, accentuate în contextul școlar. Adolescenții mai în vârstă sau cu o durată mai mare a bolii arată mai puțină frustrare, posibil datorită unor mecanisme de coping mai bune. De asemenea, HbA1c mai înalt este legat de o rezistență fiziologică percepută ca mai scăzută. Studiul relevă că maturizarea poate reduce anxietatea legată de relația cu profesorii, subliniind interacțiunea complexă dintre managementul diabetului, vârstă și bunăstarea psihologică.

Cuvinte-cheie: *dabet zaharat tip 1, adolescent, hemoglobina glicată, anxietate, stagiu de boală.*

Introduction

The prevalence of anxiety disorders among adolescents with type 1 diabetes (T1D) is notably higher compared to their non-diabetic peers, drawing a pressing need for more profound research into this correlation. The physiological stress of chronic disease management, particularly the rigorous blood glucose monitoring and the constant vigilance over hypoglycemic episodes, posits a substantial psychological burden. Anxiety, in this demographic, has been linked to suboptimal glycemic control, evidenced by elevated levels of glycated hemoglobin (HbA1c), which is a marker for long-term glucose control and an indicator of diabetes management effectiveness [1].

Studying the relationship between anxiety and HbA1c is critical for several reasons. First, it has immediate implications for the medical management of T1D, as anxiety can interfere with the ability of adolescents to adhere to treatment protocols, thereby exacerbating their condition. Second, heightened anxiety can also precipitate the onset of diabetes-related complications, which can have a profound impact on the quality of life and the overall health of these young individuals. Lastly, the teenage years are formative periods where individuals establish lifelong health behaviors. Understanding and addressing the psychological factors associated with T1D management can lead to more tailored interventions that could improve both the mental and physical health outcomes for this vulnerable population. Therefore, delving into the nexus of anxiety and glycemic control is not only relevant for current clinical practices but is imperative for shaping the future trajectory of healthcare provision for adolescents grappling with T1D [2].

Theoretical delimitations

Type 1 diabetes is an autoimmune condition characterized by the destruction of insulin-producing beta cells in the pancreas, leading to an inability to regulate blood glucose levels. Unlike type 2 diabetes, which can often be managed with lifestyle modifications, T1D requires continuous insulin administration for survival. The management of T1D is a delicate balance, necessitating frequent blood glucose monitoring and precise insulin dosing to mimic the body's normal insulin response [3].

Glycated hemoglobin serves as a pivotal marker in the monitoring of diabetes. It reflects the average blood glucose concentration over the previous two to three months, providing a more comprehensive picture of long-term glycemic control than daily blood sugar tests. A higher HbA1c level indicates poorer control of diabetes and is a predictor of diabetes-related complications. As such, HbA1c is instrumental for healthcare providers in assessing the efficacy of diabetes management plans and for adjusting treatment as needed [4].

Anxiety, a condition characterized by persistent and excessive worry that disrupts daily activities, is a common comorbidity in adolescents with T1D. This psychological state can be triggered by the constant concern over blood sugar levels, potential complications, and the social stigma associated with chronic illness. Anxiety has been found to negatively impact self-care behaviors in diabetes management, potentially leading to inconsistent blood glucose monitoring and insulin administration, thereby increasing HbA1c levels. The bi-directional relationship between T1D and anxiety can create a cyclical pattern of stress and poor glycemic control, which can further exacerbate each condition [5].

Understanding T1D, HbA1c, and anxiety is vital for developing holistic treatment approaches that address both the physiological and psychological needs of adolescents with T1D. Conceptual delimitation in this context serves not only to differentiate and define these terms but also to underline their interdependence, which is crucial for effective intervention strategies aimed at improving the lives of those affected by this chronic condition.

Methodology

This investigation aimed to elucidate the relationship between anxiety levels and HbA1c, a key indicator of diabetes control, in adolescents with Type 1 Diabetes (T1D).

The research, carried out in the field in 2022, sought to understand how anxiety might affect diabetes management among younger individuals. A cohort of 132 young patients with clinically confirmed T1D were enrolled from the Pediatric Clinic at the Endocrinology Department of IMSP Mother and Child in Chisinau, Moldova. These participants, ranging in age from 12 to 18 and with T1D for one to fifteen years, provided a diverse sample to assess the interplay between chronic disease management and psychological health.

1. Psychometric tool used in studying the anxiety levels: **Philips School Anxiety Scale** (Philips, 1978) [6] makes it possible to study in detail the level and nature of school-related anxiety in children and adolescents, to assess the emotional characteristics of the child's relationships with peers and teachers. The indicators of this test give an idea about both the general anxiety and the emotional state of the child, associated with different forms of its inclusion in school life, as well as about the particular types of manifestations of school anxiety. The test consists of 58 questions that can be read to subjects or provided in writing. Each question must be answered unequivocally: yes or no.

The scales detected and their characteristics are:

- General school anxiety: The general emotional state of the child, associated with various forms of inclusion in school life.
- Experiencing social stress: The child's emotional state, against which his social contacts develop, primarily with peers.
- Frustration of need to succeed: Unfavorable mental terrain, which does not allow the child to develop his needs for success, achieve academic performance, etc.
- Fear of self-expression: Negative emotional experiences of situations associated with the need for self-disclosure, presentation to others, demonstration of one's own capabilities.

- Fear of testing situation: Negative attitude and anxiety in situations of testing, in particular, of knowledge and skills in public.
- Fear of not meeting expectations of others: Anxiety and exaggeration of the importance of opinions about oneself and the evaluation by others of one's own value, knowledge, skills.
- Low physiological resistance: Characteristics of the psychophysiological organization, which reduce the child's adaptability to stressful situations, increase the probability of an inadequate, destructive response to an alarming environmental factor.
- Problems and fears in relationships with teachers: General negative emotional background of relations with adults at school, which reduces the child's academic success.

2. Data regarding glycated hemoglobin and disease duration: For this study, patient information concerning glycated hemoglobin levels and disease duration was collected from their medical records, with the consent of their caregivers and physicians.

Results and discussions

Manifestation of anxiety. we will provide a detailed analysis of its occurrence, with the results presented in the following table (Tab. 1):

Table 1. Distribution of results regarding anxiety in the experimental group with type 1 diabetes.

Anxiety scale	Clinical significance	Distribution within type 1 diabetes sample
General anxiety	Subclinical	71,2 %
	Clinical	28,8 %
General school anxiety	Subclinical	60,6 %
	Clinical	39,4 %
Experiencing social stress	Subclinical	81,8 %
	Clinical	18,2 %
Frustration of need to succeed	Subclinical	86,3 %
	Clinical	13,7%
Fear of self-expression	Subclinical	42,4 %
	Clinical	57,6 %
Fear of testing situation	Subclinical	63,6 %
	Clinical	36,4 %
Fear of not meeting expectations of others	Subclinical	69,6 %
	Clinical	30,4 %
Low physiological resistance	Subclinical	68,3 %
	Clinical	31,7 %
Problems and fears in relationships with teachers	Subclinical	51,5 %
	Clinical	48,5 %

Upon examining the data, we observe variability across different metrics. Notably, half of the individuals surveyed fall within the normal range on a spectrum of concerns, including General anxiety, General school anxiety, Experiencing social stress, Frustration of need to succeed, Fear of testing situation, Fear of not meeting expectations of others, as well as Low physiological resistance. However, there is a marked increase in anxiety indicators connected to „Fear of self-expression" and „Problems and fears in relationships with teachers".

Several intertwined elements may escalate the anxiety levels in these youths. Concerning health-related anxiety, the rigorous regimen required to manage type 1 diabetes can intrude on daily life and educational participation. The possibility of blood sugar variances during school hours can amplify concerns about expressing themselves, as they might face potentially disruptive or embarrassing incidents related to their glucose management.

Social integration and peer perceptions become critical during the teenage years, and for those with type 1 diabetes, there's an increased self-awareness that may lead to feelings of stigma or being judged, particularly in situations where checking blood sugar or insulin administration is necessary. Such concerns are magnified in social settings that necessitate assertiveness and vocal interaction.

Furthermore, the teen years bring about a surge in scholastic challenges and the expectation to perform well academically. Anxiousness linked to self-expression and academic achievement may arise from unrealistic goals and the fear of not meeting high standards. This stress can intensify if adolescents struggle to communicate openly about their difficulties, especially with their educators.

Teenagers managing type 1 diabetes might also encounter obstacles in communicating about their health needs, possibly due to a reluctance to draw attention or experience embarrassment. This can impede their ability to seek help or express their requirements, contributing to anxiety around the ability to convey their concerns related to diabetes effectively.

Lastly, the degree of support and understanding from educational staff regarding type 1 diabetes can significantly influence anxiety levels. A lack of proper accommodations or support in the school setting may lead to worries about managing diabetes effectively, particularly if complications such as hypoglycemic events could occur during school hours.

Correlation between anxiety, glycated hemoglobin and disease duration

Table 2. The correlation between age, HbA1c, and disease duration and anxiety in the experimental group with type 1 diabetes.

Anxiety		Age	Hba1c	Disease duration
General anxiety	Pearson Corr. Sig. (2-tailed)	-, 144 , 100	,239** ,006	-,086 ,330
General school anxiety	Pearson Corr. Sig. (2-tailed)	-, 090 , 304	,253** ,003	-,125 ,155
Experiencing social stress	Pearson Corr. Sig. (2-tailed)	-,139 , 111	,133 ,128	-,035 ,689
Frustration of need to succeed	Pearson Corr. Sig. (2-tailed)	-,360** ,000	,153 ,080	-,252** ,004
Fear of self-expression	Pearson Corr. Sig. (2-tailed)	,005 ,954	,102 ,244	,024 ,787
Fear of testing situation	Pearson Corr. Sig. (2-tailed)	-,115 ,187	,249** ,004	-,133 ,198
Fear of not meeting expectations of others	Pearson Corr. Sig. (2-tailed)	-,119 ,174	,145 ,097	-,133 ,127
Low physiological resistance	Pearson Corr. Sig. (2-tailed)	-,060 ,495	,241** ,005	,018 ,838
Problems and fears in relationships with teachers	Pearson Corr. Sig. (2-tailed)	-,238** ,006	,075 ,394	-,162 ,063

This analysis of the correlation results (Table 2) between age, HbA1c, and disease stage and anxiety offers the following observations:

General anxiety and HbA1c

The significant positive correlation between general anxiety and HbA1c levels indicates that as blood sugar control decreases (higher HbA1c), general anxiety increases. This may be due to the stress associated with managing a chronic condition like diabetes – poor blood sugar control can result in a fear of complications, leading to increased anxiety. The psychological burden of managing diabetes daily and the fear of long-term consequences can also play a role.

General school anxiety and HbA1c

A similar positive correlation is found between school-related anxiety and HbA1c levels. The management of diabetes within a school setting poses unique challenges, such as needing to monitor blood sugar and potentially needing to inject insulin during school hours. These actions can make teens feel different from their peers, contributing to heightened school-related anxiety. Moreover, worries about hypoglycemic events during exams or in-class activities can add to this stress.

Frustration of need to succeed and age

The negative correlation indicates that as teenagers with type 1 diabetes get older, they tend to experience less frustration regarding their need to succeed. With age, adolescents may develop more effective coping strategies and a more nuanced understanding of their condition, leading to better emotional regulation and reduced frustration.

Frustration of need to succeed and disease duration

The negative correlation suggests that the longer the individual has been managing their diabetes, the less frustration they feel about their need to succeed. Over time, these individuals likely become more adept at managing their condition and integrating it into their lives, which can reduce the conflict between their diabetes management and their goals for success.

Fear of testing situation and HbA1c

The positive correlation here may reflect the stress of academic performance in the context of diabetes management. Teens who struggle to control their blood sugar may have more concerns about the impact of their diabetes on testing situations – worrying, for example, about the possibility of a hypoglycemic episode during an exam, which could impair their performance.

Low physiological resistance and HbA1c

Again, a significant positive correlation with HbA1c suggests that teens who have higher HbA1c levels feel a lower sense of physiological robustness. High HbA1c can be associated with a greater frequency of symptoms like fatigue, which may be interpreted by the teens as low resistance, and the stress of constant management can take a physical toll as well.

Problems and fears in relationships with teachers and age

The significant negative correlation could be attributed to the increasing maturity and communication skills that develop with age. Older teens might be better at advocating for themselves and may have established stronger relationships with their teachers. They might also feel less intimidated by authority figures as they grow older, leading to a decrease in anxiety related to these relationships

Conclusions

In conclusion, the study's findings highlight a complex interplay between physiological, psychological, and social factors in teenagers with type 1 diabetes. The significant correlations suggest that tighter glycemic control, as indicated by lower HbA1c levels, is associated with lower levels of anxiety in several domains, emphasizing the importance of effective diabetes management for mental health. Conversely, higher HbA1c levels correlate with increased anxiety, particularly in areas that involve public aspects of diabetes

management, such as school settings, and in situations that may result in acute diabetes complications, like during tests.

Age and the duration of disease management emerge as factors that can potentially mitigate feelings of frustration and anxiety over time. As teenagers grow older and gain more experience with managing their condition, they tend to report lower levels of frustration and anxiety, indicating that maturity and adaptation to the condition play crucial roles in psychological well-being.

The study underscores the necessity for a supportive environment for teenagers with type 1 diabetes, including comprehensive education on managing their condition, psychological support to address the emotional burdens of diabetes, and a school environment that is informed and accommodating of their needs. This holistic approach can help in reducing the psychological impact of type 1 diabetes and support the youths in achieving better health outcomes, both physically and emotionally.

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