

# Relationship between Psychopathological Factors and Metabolic Control in Children and Adolescents with Insulin-Dependent Diabetes mellitus

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## ABSTRACT

*This paper provides a critical overview of the literature on the relationship between psychological/psychopathological factors and metabolic control in children and adolescents with insulin dependent diabetes mellitus (IDDM). We discuss studies on individual and family psychopathological factors, as well as reports on the effects of psychoeducational/psychotherapeutic interventions on glycemic control in patients with IDDM aged <18 years. The analysis of the literature indicates that while evidence on the relationship between individual factors and metabolic control is still mixed, in part due to methodological issues, results from family studies do suggest that patients in dysfunctional families and children of parents with high degrees of psychopathology present with poor glycemic control. As for the effects of psychoeducational/psychotherapeutic interventions, limited but increasing evidence shows that they can actually contribute to improve metabolic control. We finally suggest some future underexplored avenues of research in the field, including studies on the psychopathological and neurobiological mechanisms underlying the above mentioned findings. All this body of research should provide a strong empirical rationale for allocating resources in order to include psychiatrists within the interdisciplinary diabetes health care team.*

**Key words:** insulin-dependent diabetes mellitus, children, adolescents, psychological and psychopathological factors, metabolic control

## Introduction

Insulin-dependent diabetes mellitus (IDDM) is a chronic metabolic disease characterized by high blood glucose levels due to reduced insulin secretion<sup>1</sup>. The management of this disorder is difficult and poses significant challenges for the patient since it requires treatment regimen of diet, physical exercise, and insulin therapy by injection to achieve a normal glycemic state<sup>2</sup>. Inadequate illness management can contribute to poor metabolic (i.e. glycemic) control, increasing risk for complications, such as renal failure, cardiovascular disease, and neuropathy<sup>2,3</sup>. IDDM is the third most common chronic disease in adolescents, after asthma and cerebral

palsy<sup>1</sup>. Because of the high prevalence and the potentially severe complications of diabetes, the management of this disease has become the focus of considerable attention from diverse clinical and scientific domains, including the psychological and psychopathological ones<sup>4,5</sup>. In this paper, we provide an overview of the literature in this area, focusing in particular on the relationship between metabolic control and individual (i.e. of diabetic children and adolescents) and family psychological factors, as well as on the effects, in terms of metabolic control, of the most common psychotherapeutic and educational interventions with these patients.

## Relationship between Individual Psychological/Psychopathological Factors and Metabolic Control

According to neurobiological models, psychological dysfunctions could contribute to poor metabolic control via the potential increase, induced by psychological distress, in the levels of counter-regulatory hormones (cortisol, epinephrine, glucagon, and growth hormone) that antagonize insulin action, thus exacerbating poor metabolic control<sup>6</sup>.

Psychological problems could also affect metabolic control indirectly, through inadequate adherence to treatment regimen<sup>7</sup>. Internalized problems such as depression and anxiety may lead to lack of energy and interest, feelings of helplessness and hopelessness, worry and fear, which, in turn, may negatively impact on adherence to diabetes regimen<sup>7</sup>. Also externalized symptoms, including aggressiveness and conduct problems, may contribute to poor metabolic control, interfering with the patient's ability to follow the rules associated with the diabetes regimen such as administering insulin at the right times and following a diet, which in turn can lead to poor metabolic control<sup>7</sup>.

Psychoanalytical interpretations suggest that poor metabolic control may represent the solution of a conflict in vulnerable individuals<sup>8</sup>. Anxiety associated with psychosexual development may lead these patients to mismanage their diabetes in order to retard physical maturation by means of recurrent metabolic derangement<sup>8</sup>.

In spite of all these models suggesting a possible significant association between psychological dysfunctions and poor metabolic control, the results of empirical research in this area have been inconsistent.

While some studies have found that both internalized (e.g.<sup>9,10</sup>) and externalized problems (e.g.<sup>7,11</sup>) were significantly associated with a poor metabolic control, others failed to replicate these findings (e.g.<sup>12,13</sup>). Dantzer et al.<sup>4</sup> suggested that the discrepancy in these results may be due to methodological issues, including different statistical approaches used in the previous studies and the lack of analysis on the role of third variables which may mediate or moderate the relationship between psychological factors and metabolic control, explaining the heterogeneity of the findings.

In order to gain insight in the role of some of these possible variables, some studies have assessed coping strategies and specific personality traits and characteristics in relation to glycemic control<sup>16–22</sup>. »Coping« refers to »cognitive and behavioural efforts directed to ameliorate or overcome a wide range of stressful demands, either by actively changing the problem that is causing distress (problem-focused coping) or by regulating emotional responses to problems (emotion-focused coping)«<sup>14</sup>. Since both high life stress and diabetes-specific stress have been related to poor metabolic control<sup>15</sup>, it can be hypothesized that coping factors may mediate the impact of psychopathology on metabolic control modulating the level of psychopathology-associated stress. Indeed, emo-

tion-focused<sup>16,17</sup> and avoidance coping<sup>17</sup> have been found to significantly correlate with poor metabolic control, in particular in male adolescents more than in pre-adolescents or in females<sup>18,19</sup>.

As for personality traits and characteristics, Vollrath et al.<sup>20</sup> found that better glycemic control was related to a personality pattern of high agreeableness, high conscientiousness and low neuroticism. Child self-esteem was significantly correlated with metabolic control in the study by Grey and co-workers<sup>21</sup>. Findings on locus of control are mixed: while Evans et al.<sup>22</sup> reported that patients with an external locus of control were more likely to present with a good metabolic control than those with internal locus of control, this result was not confirmed by Gross et al.<sup>23</sup>

Some studies have also examined how gender moderates the influence of psychological factors on metabolic control<sup>24,25</sup>. Adolescent girls have been found to be on worse metabolic control than adolescent boys, and present with more symptoms of depression and anxiety<sup>24</sup>, as well as with more behavioral problems<sup>25</sup>.

Although the previous studies exploring the possible mediating role of personality and demographic factors represent advancement in research on the relationship between individual psychopathological factors and metabolic control, we believe that further improvements in the study methodology are needed to understand how and to what extent individual psychopathological factors may impact on glycemic control. First, we point out that most of the previous studies are cross sectional, and therefore, cannot establish causality between psychopathology and metabolic control. Second, most of the previous studies used self report questionnaires. The use of semi-structured interviews may provide more valid measures. Third, some of the previous studies used simple statistical comparisons. The use of regression analyses, control for possible confounding factors, may allow more conservative and, therefore, specific estimates of the relationship between individual psychopathology and metabolic control.

## Relationship between Family Dynamic/Psychopathology and Metabolic Control

Parents have an active role in the management of their children's diabetes, being responsible for diabetes care during the childhood years and then guiding their sons and daughters towards autonomous responsibility of diabetes management in adolescence<sup>26</sup>. Therefore, it is not surprising that a large body of research has investigated relations between psychological family variables and metabolic control in pediatric patients with type 1 diabetes<sup>11,20,21,26–41</sup>. Some studies have specifically examined psychological family dynamic<sup>11,27–38</sup>, while others have focused on psychological and psychopathological traits of mothers and/or fathers of children with IDDM<sup>20–22,26,38–41</sup>.

As for family dynamic, most studies suggested that children with more structured, cohesive, and supportive family environments present with a better diabetes control. In particular, supportive family communication patterns, high emotional expressiveness<sup>27</sup>, sufficient (but noncoercive) parental guidance with diabetes treatment regimen<sup>28</sup>, and greater emotional involvement of parents<sup>29</sup> have been found to be associated with better glycemic control. On the contrary, negative and unsupportive parental behavior patterns related to diabetes care behaviors (e.g., coercion, nagging, threats, criticism, and scolding) have been correlated with both poorer metabolic control and poorer regimen adherence<sup>30</sup>. A lack of family cohesion may result in a child perceiving less concern and experiencing less monitoring and reminders to engage in appropriate health behaviors<sup>11</sup>. According to Wysocki<sup>31</sup>, it is not the presence of familiar conflicts, but the lack of conflict resolution skills to negatively impact on metabolic control. Although most of the previous results come from studies with relatively limited sample sizes, a large, international, multicentre study has confirmed that there is a significant relationship between good metabolic control and following family variables: parents living together, paternal employment status, parents perceived to be over-involved in diabetes care and adolescent-parent disagreement on responsibility for diabetes care practices<sup>32</sup>.

It has also been assessed how some variables, such as diabetes duration, patient's age, and gender moderate the relationship between family psychological variables and metabolic control. The interrelationships among family conflict, adherence, and glycemic control was especially strong in youth with short duration of IDDM<sup>33</sup>. Older adolescents reported increased family dysfunction and had higher HbA1c values than preadolescents<sup>34</sup>. Adolescents whose parents maintain some guidance and control in the management of diabetes have better metabolic control<sup>26</sup>. Continuing to involve parents appropriately, with shared management, was associated with improved control<sup>26</sup>. Grey et al.<sup>35</sup> correctly points out that the challenge is to find the degree of parental involvement that is comfortable for all involved, without risking poorer control from over involvement or under involvement.

Some longitudinal studies have provided useful insights in the cause-effect pathways between psychological factors and glycemic control, confirming that high family cohesion<sup>11</sup> and high verbal expressiveness<sup>36</sup> do predict better glycemic control.

Several authors have suggested potential psychopathological and, to less extent, neurobiological mechanisms underlying the above mentioned significant relationship between psychological family factors and glycemic control<sup>11,38</sup>. According to Cohen et al.<sup>11</sup>, negative family functioning processes (e.g. negative and critical parenting) have a negative impact on children's adherence behaviours and subsequent metabolic control. It has also been proposed that family conflict could contribute to stress in the child directly, leading to elevated glucose levels from increased stress hormones<sup>38</sup>.

Studies that focused on parental psychological variables examined, in particular, personality traits, cognitive factors, and psychopathological dimensions of parents<sup>20,21,26,38–41</sup>. As for personality traits, higher parental self-esteem was found to be associated with better family functioning, higher child's self-esteem, better child's psychosocial adjustment and metabolic control<sup>21</sup>. Moreover, mothers of children with better glycemic control showed higher agreeableness than mothers of patients with poor metabolic control; they also used committed, but non-confrontational style of monitoring their children's diabetes management<sup>20</sup>.

Parental psychopathological dimensions assessed as variables possibly correlated to metabolic control include in particular anxiety and alexithymia<sup>38–41</sup>. Cameron et al.<sup>38</sup> found that maternal trait anxiety was associated with higher glycated haemoglobin levels and greater absenteeism (skipping regular doctors' appointments) in younger adolescent patients. To explain this finding, Cameron et al.<sup>38</sup> used the concept of »miscarried helping«, where well-intentioned parental efforts to maintain the child's health are not successful because they conflict with the child's needs for autonomy<sup>39</sup>. Also parental alexithymia (difficulty identifying emotions) was found to be a significant predictor of a child's glycemic control<sup>40</sup>. Moreover, higher maternal alexithymia was related to more frequent children's hospitalizations for hyperglycaemia and lower family cohesion<sup>40</sup>.

While most of the studies have focused on family as a whole, or mothers, a couple of studies have assessed fathers' psychological variables<sup>41,42</sup>. Forsander<sup>41</sup> reported that the fathers of children with poorly regulated IDDM expressed higher levels isolation, chaos and enmeshment as compared to the fathers of children with IDDM and diabetic patients with good metabolic control. Worall-Davies<sup>42</sup> found that paternal hostility (absent and rejective fathers) was significantly associated with elevated glycaemic haemoglobin.

Therefore, the bulk of the studies on the relationship between family psychological factors and metabolic control do suggest a significant association. Further research is needed on the possible psychopathological pathways underlying this association, exploring possible psychodynamic, genetic, and neurobiological factors, as well as their interplay. Moreover, given that most of the studies examined the role of mothers' characteristics, we think that more research should be conducted on the fathers' variables related to metabolic control.

### **Effect of Psychotherapeutic/ Psychoeducational Interventions on Metabolic Control**

The most common intervention approaches for youth with IDDM that we found in literature include psychoeducational interventions, behavioral psychotherapeutic techniques, problem solving skills techniques, behavioral family systems therapy, multisystemic therapy, and psychoanalytic therapies<sup>8,43–50</sup>.

Educational programs for youths with diabetes emphasize factual knowledge about the disease process. When combined with other supportive interventions, psychoeducation has been shown to be effective in improving metabolic control<sup>43</sup>.

A lot of attention has been turned to research on effectiveness of behavioral psychotherapeutic techniques, including coping skills training (CST)<sup>44</sup>. The goal of CST is to increase child's or adolescents' sense of competence and mastery by retraining inappropriate or non-constructive coping styles and forming more positive styles and patterns of behavior<sup>44</sup>. Work mostly by Grey's team has shown that CST may significantly improve metabolic control and quality of life of children and adolescents with insulin-dependent diabetes mellitus<sup>44</sup>. Interestingly, these effects were long lasting<sup>44</sup>. It is possible that, by teaching patients how to deal effectively with stressors that they encounter in their daily lives, fewer stress reactions should result from these difficult situations, leading to better overall diabetes control.

Results of research that evaluated the effect on metabolic control of interventions aimed at improving problem solving skills, as one aspect of coping with stress, are inconsistent, although most of studies found no significant effects<sup>45–47</sup>.

The revised version of the behavioural family systems therapy (BFST-D), focusing on certain family communication issues specific for children and adolescents with IDDM, has been reported to significantly improve family conflict and treatment adherence and reduce glycated haemoglobin levels, particularly among adolescents with poor metabolic control<sup>48</sup>.

Multisystemic therapy, which is a home-based psychotherapy with interventions that encompass adolescent, family system, and the broader community systems within which the family operates, has been shown to significantly improve metabolic regulation in adolescents with IDDM<sup>48</sup>.

Moran et al.<sup>8</sup> evaluated the effectiveness of an intensive inpatient program combining intensive psychoanalytic psychotherapy of children, psychoanalytically informed parental counselling and medical management. The scope of this psychological intervention was to help the children understand the conflicts and maladaptive defences that may have contributed to their current state of psychological distress. The treatment led to durable and significant improvements in metabolic control maintained at 1-year follow-up<sup>8</sup>.

Since, for each intervention, few empirical data are available, there is clearly a need for further research in the field. Studies should also be encouraged on the possible combination of one or more of the previous approaches. Finally, research on the psychopathological and neurobiological mechanisms by which the previous therapies lead to improvement in metabolic control is still lacking and should be encouraged.

## Discussion and Conclusion

A large body of research is currently available on the relationship between psychological/psychopathological factors and metabolic control in children and adolescents with IDDM. Results from studies investigating the relationship between individual psychopathological variables and glycemic control are still in part mixed, with some studies finding a significant relationship between poor metabolic control and psychopathology<sup>7,9–11,17</sup>, while others reporting a lack of association<sup>12,13</sup>. It is possible that some methodological issues related to sample size, study design, statistical analysis, and measures selection, account for the heterogeneity in the results. Further methodologically sound research should allow us to gain better insight into this topic, although current research suggests that psychological dysfunctions may, at least in a subset of patients, negatively impact on glycemic control.

On the other hand, evidence on the relationship between family psychological factors and metabolic control is more consistent, showing that patients in dysfunctional families and children of parents with high degrees of psychopathology present with poor glycemic control<sup>11,30–34</sup>, while the presence of structured, cohesive, and supportive family contributes to a better metabolic control<sup>27–29</sup>. However, the psychological and neurobiological mechanisms underlying this and other somatic relationships are still underexplored and may be addressed in future research by means of modern approaches and tools<sup>50</sup>.

With regard to the effects of psychological interventions on metabolic control, preliminary evidences suggests that several approaches, such as psychoeducational interventions, behavioural psychotherapeutic techniques, problem solving skills techniques, behavioural family systems therapy, multisystemic therapy, and psychoanalytic therapies, could be effective in favouring a good metabolic control<sup>8,43–50</sup>. However, given the paucity of methodologically sound studies in this area, further research on these interventions, alone as well as in combination, is welcome.

All this body of research may have important implications for clinical practice and management of IDDM in youths, providing a strong empirical rationale for allocating resources in order to include professionals with expertise in the mental and behavioral health of children and adolescents within the interdisciplinary diabetes health care team. Results from future research might confirm that, along with psychological interventions targeted at children and adolescents, attention should be paid to the adaptive functioning of the family system. However, clinicians should keep in mind that in some cases good metabolic control may not be related with optimal psychological adjustment, so they should be alert to symptoms of lowered mood, anxiety, and obsessive tendencies in their young patients with well-controlled diabetes.

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## POVEZANOST PSIHOPATOLOŠKIH FAKTORA I METABOLIČKE KONTROLE U DJECE I ADOLESCENATA OBOLJELIH OD INSULIN-OVISNOG DIJABETESA MELLITUSA

### SAŽETAK

U radu je prikazan kritički pregled literature o povezanosti psiholoških i psihopatoloških faktora i metaboličke kontrole u djece i adolescenata s insulin-ovisnim dijabetesom mellitusom. Zasebno su prikazani individualni i obiteljski psihopatološki faktori, kao i utjecaj psihoterapijskih i psihoedukacijskih intervencija na kontrolu glikemije. Dok su

rezultati istraživanja o povezanosti individualnih psiholoških faktora i metaboličke kontrole proturječni, djelom zbog metodoloških razlika, rezultati istraživanja obiteljskih faktora ukazuju na povezanost lošije metaboličke kontrole i disfunkcionalnih obiteljskih odnosa. Ograničen broj istraživanja ukazuje na učinkovitost psihoterapijskih i psihoedukacijskih mjera u poboljšanju metaboličke kontrole. U radu predlažemo moguća daljnja područja istraživanja, uključujući studije o psihopatološkim i neurobiološkim mehanizmima koji bi mogli utjecati na regulaciju glikemije. Značajan broj dosadašnjih istraživanja čiji rezultati upućuju na ulogu psihopatoloških faktora u metaboličkoj regulaciji predstavlja empirijski razlog za uključivanje psihijatara u interdisciplinarni tim liječnika koji se bave djecom i adolescentima oboljelim od insulin-ovisnog dijabetesa mellitusa.