Psychosocial problems in adolescents with type 1 diabetes mellitus

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Abstract

Adolescents with diabetes are at increased risk of developing psychiatric (10–20%) or eating disorders (8–30%), as well as substance abuse (25–50%), leading to non-compliance with treatment and deterioration of diabetic control. At high risk are female adolescents with family problems and other comorbid disorders. Impaired cognitive function has also been reported among children with diabetes, mainly in boys, and especially in those with early diabetes diagnosis (<5 years), or with episodes of severe hypoglycaemia or prolonged hyperglycaemia. Type 1 diabetes mellitus contributes to the development of problems in parent–child relationships and employment difficulties, and negatively affects the quality of life. However, insulin pumps appear to improve patients’ metabolic control and lifestyle. The contributions of family and friends to the quality of metabolic control and emotional support are also crucial. In addition, the role of the primary-care provider is important in identifying patients at high risk of developing psychosocial disorders and referring them on to health specialists. At high risk are patients in mid-adolescence with comorbid disorders, low socioeconomic status or parental health problems. Multisystem therapy, involving the medical team, school personnel, family and peer group, is also essential. The present review focuses on the prevalence of nutritional and psychosocial problems among adolescents with diabetes, and the risk factors for its development, and emphasizes specific goals in their management and prevention.

Keywords: Type 1 diabetes mellitus; Children; Adolescents; Psychiatric disorders; Eating disorders; School performance; Contraception; Family/friend relationships; Review

Résumé

Les adolescents atteints de diabète de type 1 (DT1) ont une augmentation du risque de développer des troubles psychiques (10–20%) ou alimentaires (8–30%), qui conduisent à la non-adhésion au traitement et à la détérioration de l’équilibre glycémique. Les risques sont accrus pour les adolescents avec des problèmes familiaux et d’autres troubles. Par ailleurs, des troubles d’apprentissage ont été mentionnés chez les enfants atteints de diabète de type 1 (DM1), surtout chez les garçons et chez les enfants chez qui le diabète a été diagnostiqué tôt (inférieur à cinq ans) ou chez les enfants qui ont présenté des épisodes d’hypoglycémie sévères ou d’hyperglycémie prolongée. La présence du DT1 contribue au développement de problèmes dans la relation parent–enfant, à de mauvais résultats scolaires, des problèmes d’emploi et à une moins bonne qualité de vie. Les pompes à insuline semblent améliorer l’équilibre glycémique des patients ainsi que leur mode de vie. Néanmoins, la contribution de la famille et des amis à la qualité de l’équilibre glycémique, grâce à leur support émotionnel, sont d’une importance cruciale. Entre autres, le personnel soignant a un rôle important dans l’identification des adolescents atteints de TD1 susceptibles de développer des troubles psychosociaux et leur orientation vers le spécialiste. Ces malades à haut risque sont des jeunes en milieu de leur adolescence avec des troubles associés, un milieu socioéconomique modeste ou des problèmes familiaux. Il est nécessaire d’associer dans ce cas les équipes médicales avec le personnel scolaire, la famille et les amis pour faire face à la situation. La présente revue se focalise sur la prédominance des problèmes psychosociaux parmi les adolescents diabétiques, sur les facteurs de risque de développement de ces problèmes, sur leurs complications, et met l’accent sur les objectifs spécifiques de leur prise en charge aussi bien que sur leur prévention.

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Mots clés : Diabète de type 1 ; Adolescents ; Enfants ; Troubles psychiatriques ; Troubles alimentaires ; Performances scolaires ; Contraception ; Relations familiales et amicales ; Revue générale

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1. Introduction

Type 1 diabetes mellitus (T1DM) is a lifelong metabolic disorder that is treated with a complex regimen of insulin injections, diet and exercise, and can greatly affect the lives of the adolescent patient and his family.

Adolescence is a period of major physiological and psychological changes, and is also characterized by an effort in young people to establish their identity and gain independence. Teenagers with T1DM have the additional burden of diabetes management. Glycaemic control usually deteriorates during adolescence [1]. Although this deterioration is partly related to hormonal changes of puberty, and to psychosocial and behavioural problems, non-compliance with the treatment regimen is of equal importance, as is knowledge of the illness and its treatment [2].

In addition, as teenagers become increasingly independent, they may resent parental supervision of their diabetes care [2]. As diabetes control is considered a family enterprise, such parental involvement in the adolescent’s life is associated with the development of problems in the parent–child relationship [3].

Psychiatric and eating disorders are reported to be more frequent among adolescents with diabetes than among their non-diabetic peers [4]. Because of their frequent psychosocial problems and their increased need for peer acceptance, adolescents with diabetes are also at high risk of substance abuse [5]. In addition, the presence of diabetes may be associated with poor school performance and employment difficulties. Health care providers also need to advise adolescent girls with diabetes on the prevention of unplanned pregnancy and its dangers.

The present review focuses on the prevalence, risk factors and consequences of nutritional, psychosocial and gynaecological problems among adolescents with T1DM, and their effects on glycaemic control and quality of life (QoL). This report also emphasizes on the need for standards and specific targets in the management of this age group as outpatients, the identification of high-risk adolescents with T1DM, and the need to establish preventative and early interventional strategies.

2. Eating disorders

Disturbed eating behaviours are a particular concern among patients with T1DM; these mainly include bulimia nervosa (BN) and binge-eating disorder (BED), whereas anorexia nervosa (AN) is rare. Sometimes, these behaviours are associated with inappropriate compensatory habits to prevent weight gain (purging behaviours) such as excessive exercise to lose weight, self-induced vomiting, the use of laxatives and insulin omission [6].

The prevalence of eating disorders among adolescents with T1DM ranges from 8% to 30%, which is significantly higher than among their non-diabetic peers (1–4%), and is more frequently seen in girls (37.9%) than in boys (15.9%) [7]. Colton et al. [8], reported, in a group of adolescent girls with diabetes (mean age: 11.8 years), a 50.8% prevalence of eating disorders that persisted 5 years later (49%). Among preadolescent girls with diabetes (aged 9–13 years), a lower frequency (17%) of eating disorders has been observed [9]:

- 16% reported dieting for weight control;
- 2% were binge-eating;
- 3% indulged in excessive exercise
- 1% used insulin manipulation for weight control.

No cases of anorexia or bulimia were observed [9].

BN is characterized by an excessive consumption of food (> 500 calories per episode) that is not part of the scheduled meals, with no consideration of its nutritional value [10]. The main difference between BN and binge-eating is that the former is characterized by purging behaviours with a frequency of more than twice a week [6].

Insulin omission refers to the skipping or reduction of the prescribed insulin to prevent weight gain [6], and has been reported in 15–40% of adolescents with T1DM [11]. Mainly observed in BN, it is also seen in AN as a means of preventing hypoglycaemia [6].

Rodin and Daneman [12] have suggested the following potential pathway from T1DM diagnosis to unhealthy weight-control behaviours. Before the diagnosis of diabetes, there is often weight loss in the adolescent, which may be desirable in the case of young girls. But once insulin therapy begins, weight gain usually occurs, which can lead to or increase body dissatisfaction. Weight gain and body dissatisfaction can, in turn, lead to the use of unhealthy weight-control behaviours, especially insulin restriction as a way to lose weight [13].

AN is a rare eating disorder in adolescents with T1DM [14,15], and is even more unusual in childhood; for this reason, there is only one study in children with diabetes, starting at the age of 8 years [16]. The cause of the condition is considered to be the result of the dietary restrictions applied to children with diabetes. Food may then become a major enemy to the child or the main reason for conflicts with parents [17]. The increased insulin requirements and recurrence of hyperglycaemia may also trigger an eating disorder in a subject so prone [17].

Several studies have identified the potential risk factors for the development of disordered eating attitudes and behaviours in diabetic adolescents, including:

- female gender;
- age 13–14 years for girls and above 16 years for boys, when adolescents struggle to adapt to the hormonal and psychosocial changes associated with puberty [17,18];
- increased body weight (partially attributed to insulin therapy), leading to denial and rejection of the body image (body dissatisfaction) [8];
- constant food preoccupation because of diabetes [8,15];
- presence of eating disorders in parents (especially the mother) [9];
- presence of other psychiatric disorders (such as depression, anxiety or substance abuse) [11];
- problems with family relationships (lack of trust in the parents regarding diabetes control, or parental conflicts) [7].
An important complication of BN and BED is poor glycaemic control and frequent episodes of diabetic ketoacidosis (DKA) [19]. Poor glycaemic control is also a complication of AN (due to insulin dose reduction), but a more serious hazard is the frequent hypoglycaemic episodes due to skipping meals, which may even be fatal [17]. Eating disorders are also responsible for the increased prevalence of long-term diabetic complications, such as retinopathy, neuropathy and nephropathy [17], because of poor metabolic control. Rydall et al. [20] reported that the prevalence of retinopathy, among adolescents with diabetes and a 5-year history of eating disorders, was 86%, in comparison with a prevalence of 24% in adolescents with T1DM of a similar disease duration, but no eating disorders [20].

Taking into consideration the severity of eating disorders, early diagnosis with screening programmes during the pre-pubertal ages is important. Special attention should also be given to girls who are not satisfied with their body image, who present with insulin omission or excessive exercising, or who have recurrent hospitalizations because of poor glycaemic control or episodes of DKA, as well as children with body weight increases and disturbed family relationships [7].

3. Psychiatric and behavioural disorders

Psychiatric and behavioural disorders in adolescents with T1DM are commonly seen [21,22], and are categorized as either “internalizing” (such as depression and anxiety) or ‘externalizing’ (such as impulsivity, hyperactivity, aggression) disorders [23,24].

In the initial period after diabetes diagnosis, children show difficulties in coping with the disease, often presenting with feelings of sadness, withdrawal and anxiety; 30% develop clinical adjustment disorder in the 3-month period following diagnosis [21,25]. Such difficulties often resolve within the first year, but poor adaptation at this initial phase places children at risk for later psychological difficulties [21,22]. In longitudinal studies, the 10-year timepoint and lifetime prevalence rates of psychiatric disorders in youngsters with T1DM were 47% [22] and 37% [21], respectively. These disorder rates are two to three times higher than those found in the general community [26,27]. In general, over one third of children with diabetes develop a psychiatric disorder within the first decade of disease onset [28], with depression, anxiety and behavioural disorders being the most common diagnoses [4,29].

Different studies have observed depression in 10–26% of adolescents with diabetes [30,31], while high rates of anxiety (9–19%) and disruptive behavioural disorders (12–20%) have also been reported [21,22,24,32]. Comorbidity is commonly seen, with up to 60% of those with a psychiatric diagnosis meeting the criteria for more than one disorder [21].

Predisposing factors contributing to depression or anxiety disorders are demographic (female gender), diabetes-specific (poor glycaemic control) and family-functioning variables (diabetes-specific burden reported by the parents) [22,31]. Indeed, female patients are more likely to have depression, anxiety or low self-esteem [31,33]. Less frequent blood glucose monitoring—an indicator of suboptimal compliance—and poor metabolic control have also been associated with higher levels of depressive symptoms [31]. In addition, there may be an association with familial patterns of depression—most frequently, maternal depression—and the presence of diabetes-specific family conflicts can cause stress to parents or caregivers, which may reduce the psychoemotional support given to young patients [31]. Furthermore, adolescents with T1DM are at increased risk for depression compared with their peers due to increased peer pressure, the attempt to gain independence from their parents and the effort to discover their self-identity [31,34,35].

Depression and other emotional disorders are associated with poor glycaemic control in both adolescents [36,37] and adults [38], resulting in frequent hospital admissions due to episodes of DKA or severe hypoglycaemia [39]. Poor glycaemic control in adolescents with diabetes and depression may be attributed to a lack of compliance with diet, exercise and medications [37].

In addition, there is an increased incidence of coexisting eating disorders in adolescents with diabetes and psychiatric disorders, which is associated with intentional insulin omission and, thus, impaired metabolic control [30,40]. Furthermore, apathy and lack of self-care, which are frequently seen in patients with depression or anxiety disorders, can lead to eating or exercise habits that cause diabetic control to deteriorate [41].

The combination of diabetes and depression in children and adolescents has been associated with a tenfold increase in suicide and suicidal ideation [42]. In children and especially adolescents with T1DM, the recurrence and course of depression may be more intense (some studies suggest that the depression tends to be more severe, more difficult to resolve and more likely to recur) than in youngsters without diabetes [31,43].

It has also been reported that suicidal ideation in adolescents with T1DM is higher than expected, but comparable to that of the general population [30,44]. Although many young adolescents with diabetes admit to suicidal ideation, only a few have attempted suicide [41], commonly using diabetes-related methods such as insulin misuse [41,45,46] or overdose.

The risk for suicidal ideation is higher among children with longer duration of diabetes, non-compliance with therapy, coexistent psychiatric disorders and single-parent families [30]. Among adolescents with T1DM who were admitted to hospital for recurrent coma due to secret self-administration of insulin, there was a large predominance of girls who had either familial difficulties or major fears of diabetes complications [45].

Thus, routine psychological screening of adolescents with diabetes and their specific follow-up is of great importance [47] for the early detection of psychiatric disorders and the prevention of suicidal attempts. Adolescents suspected to have psychiatric disorders are those with frequent hospital admissions because of DKA, or those with severe diabetes-related family problems, and also those who have severe conflicts with their parents. Youngsters with internalizing disorders (depression and anxiety) may be less noticeable to their parents and teachers than those with externalizing symptoms, such as anger and aggressive outbursts. For this reason, the clinician should question their younger patients with T1DM about specific symptoms of depression. Adolescents suspected to have
psychiatric disorders need closer follow-up in terms of diabetes control and psychological interventions.

4. Self-management of diabetes, compliance and glycaemic control

Optimal glycaemic control is important for delaying progression to long-term complications of T1DM [48]. Studies by the Hvidore group and others [49–52] have demonstrated that glycaemic control between 11 and 18 years of age remains poor. This is mostly attributed to the normal physiological changes of puberty, as increased levels of growth hormone are responsible for overnight insulin resistance—also known as the “dawn phenomenon” [53].

However, other factors such as psychosocial and behavioural problems, and non-compliance with treatment, also play important roles in the development of metabolic dysregulation in adolescence. As teenagers become increasingly independent, they resent parental supervision of their diabetes care and rebel against the restrictive nature of diabetes treatment regimens. Reluctance to do more than the minimum number of blood glucose tests, erratic meals and missed insulin doses are frequently seen [54,55]. In addition, as previously mentioned, the incidence of depression, eating disorders and insulin omission is increased in adolescence, which, in turn, increases the risk of deterioration of glycaemic control. Moreover, many adolescents cannot understand the long-term consequences of T1DM, tend not to believe that they are vulnerable to them and hold the view that they will never happen to them [56].

Another factor associated with poor glycaemic control is non-compliance with treatment. During the first years of diabetes diagnosis [57,58], the lack of adequate knowledge of diabetes can affect compliance in children and adolescents [59]. After this initial phase, though, compliance depends on the avoidance of unhealthy self-care behaviours, and the degree of parental support given to diabetes management [60,61]. In fact, the relationship between compliance behaviours and glycaemic control is highly complex and probably bidirectional, as poor compliance is often preceded by an initial worsening of glycaemic control [2]. Indeed, it is likely that the deteriorating metabolic control during early adolescence because of hormonal factors, despite stable compliance and continued self-care, can seriously discourage adolescents’ subsequent self-care efforts and, thus, contribute to the decline seen in older adolescents’ self-care behaviours [2].

Other factors that predispose to young patients’ non-compliance are the presence of other health problems, and learning, emotional and behavioural disorders. Also, family factors such as a single-parent home, chronic mental or physical health problems of the parents, low socioeconomic status and particular cultural or religious beliefs may all contribute to poor compliance with therapy [62].

The hormonal and psychological changes of puberty are complicated by the demands of the intensified treatment regimens used in adolescence, which can result in poor glycaemic control [63]. Intensified treatment is necessary to ensure normal physical growth [64] and secondary sexual development, and also to prevent or retard the development of long-term microvascular complications. Adverse effects of intensified glycaemic control are the inconvenience of frequent blood tests, weight gain and more frequent bouts of severe hypoglycaemia due to hypoglycaemia unawareness [65].

Nevertheless, it is difficult to achieve near-normoglycaemia during adolescence. Indeed, several studies in the US and Europe [31,48,62] have documented that mean HbA1c levels in adolescence are generally greater than 8.0%. Reducing these levels increases the risk of severe hypoglycaemia. For this reason, the American Diabetes Association [62] has concluded that, although an ideal target HbA1c identical to that for adults (<7%) might be recommended for adolescents, it is recognized that this target is not easily achieved in most young patients. Thus, bearing in mind the risk of hypoglycaemia and the possibility of creating feelings of failure in the patient, an HbA1c level of less than 7.5% is recommended for this age group [62].

5. Diabetes-pump therapy

Continuous subcutaneous insulin infusion (CSII) is becoming increasingly popular as a means of delivering insulin, being used by nearly 8% of adults and 6% of children with T1DM around the world [66].

Compared with the multiple daily injection (MDI) regimen, the use of insulin pumps is associated with lower HbA1c levels, fewer episodes of severe hypoglycaemia (especially in patients under 5 years of age), low risk of ketoacidosis and greater reduction of glucose fluctuations [67,68]. Also, long-term improvements in metabolic control over a 5-year period have been observed [68]. In addition, with CSII, the total daily insulin dose may be significantly decreased [67], while there are mixed reports of an increase in body mass index (BMI) associated with pump use [69,70].

As for the impact on patients’ lifestyle, most studies report that CSII provided patients with greater flexibility, freedom and ease with meals, and reduced feelings of physical restriction [71]. However, there is conflicting evidence regarding the QoL of patients treated with the insulin pump compared with MDI [72–74]. Nevertheless, most studies of adolescent and adult pump-users have shown a decrease in depressive symptoms, with no differences in anxiety, self-esteem and locus of control [75,76].

However, the disadvantages of the pump include the continual reliance on an external device, and the need for intensive blood glucose monitoring and high patient motivation [77]. Also, their proper use requires a good understanding of how diabetes, food and insulin all interact, and their cost is considerable [74].

Among the necessary factors for CSII treatment success, it is important to identify those patients who have unrealistic expectations with using the pump, a disturbed body image and a lack of social support [71]. Women using CSII show higher levels of self-consciousness and body dissatisfaction [71,78], while adolescents report feeling different and less acceptable, and consider pumps to be fashion inconveniences [71].

Thus, insulin-pump therapy is a suitable alternative to insulin injections in some adolescents, as it appears to improve patients’
metabolic control and lifestyle while placing fewer disease-related limitations on the family. However, its application demands active participation in self-care and realistic expectations [79].

6. Family relationships

Type 1 diabetes is a demanding chronic illness that influences patients’ everyday life, and has particular implications on adolescents and their families. Given that diabetes management must be integrated into the family’s lifestyle, it is likely to affect every family member. Parents often become involved in aspects of their teenagers’ lives that they would otherwise ignore [80]. The increased responsibility and demands of diabetic treatment can lead to parent–child conflicts. Furthermore, parental involvement may be in conflict with the adolescent’s developing sense of autonomy [81].

The growing autonomy and creation of a personal identity are important developmental tasks of adolescence [82]. These tasks may be more complicated for adolescents with T1DM because, at this time in their lives, both metabolic control and treatment compliance are likely to deteriorate [61,81]. It has been found that less parental involvement in diabetes care is associated with poorer diabetes outcomes [83]. In contrast, adolescents whose parents remain involved in their self-care activities have better compliance and more effective glycaemic control. However, increased parental involvement in diabetes management is also reported to create diabetes-related family conflicts [84]. Indeed, high levels of family conflict, and low levels of family cohesion and support, are associated with poorer metabolic control and poorer compliance with treatment among adolescents [85].

Another effect of diabetes on parental behaviour is the high burden of stress that parents carry for the wellbeing of the affected child. Parents often express excessive worry over diabetes and its treatment, especially concerning high and low blood sugar levels and long-term diabetes complications, in addition to the usual adolescent activities such as driving. This worry is often expressed by intrusive behaviours such as nagging, scolding, asking too many questions and giving orders [86]. Sometimes, parents will question their adolescents’ management decisions, resulting in disrupted communication and resentment.

Another reason for child–parent conflict is the lack of understanding in the parents, leading to intrusive and blaming behaviours. Thus, although these parents are attempting to help, they are, in fact, suggesting that their child or adolescent is incapable of managing the diabetes rather than truly helping their child to learn how to manage the illness [87].

Adolescents, on the other hand, consider their parents’ behaviour as “annoying” and, at times, accuse them of “losing sight of them as people” and of seeing them solely as “having diabetes” [86]. They may also feel frustration and guilt over the effect of diabetes on their parents, and the stress it can cause to the family [84].

Nevertheless, many families are able to raise their adolescents with T1DM without excessive trouble. These families approach problems with warmth and empathy, rather than hostility and anger, and have clearly defined goals and expectations. By anticipating imperfection in self-management, they encourage the appropriate level of autonomy, using social support systems and effective communication to solve the problems together [88].

Several family-related factors are associated with diabetic adolescents’ behaviours and non-compliance, including having a single-parent family, lower socioeconomic status, high levels of family conflict, poor family communication and poor problem-solving skills [89]. If a child or family is identified as being at high risk of non-compliance with treatment and having problems in their relationships, they need to be scheduled for outpatients follow-up by a specialized psychologist.

7. Relationships with friends and the opposite sex

In middle childhood, as children spend increasing amounts of time outside of the family, they become affiliated with peer groups, spending more time with them and deriving significant support from such friendships [90]. The support of friends for an adolescent with diabetes is mostly orientated towards companionship (such as during exercise) and emotional support, and less frequently towards helping with insulin injections and blood glucose testing [90]. Also, girls have more support than boys for diabetes control and emotional problems, which may be attributed to the more intimate nature of female compared with male friendships [90,91]. There is some indication that friends’ support for blood glucose testing is predictive of compliance in diabetes [92], and may be related to the adolescent’s disease adaptation and QoL [90].

Nevertheless, peers may sometimes lack sufficient knowledge of diabetes and of the importance of daily care management, so they may not support the diabetic friends in a regular and consistent manner, and may even have an influence that is either neutral or detrimental to the daily care regimen [91,93].

7.1. Romantic relationships

Adolescents with diabetes are no different from their non-diabetic peers as regards dating attitudes, as they have similar psychosocial maturity [94]. However, they tend not to focus as much on intimacy in their relationships as their non-diabetic peers, and look for romantic partners who can offer them security, support and assistance in a stable relationship [95]. In addition, adolescents with T1DM are reported to experience less trust and less of a sense of intimate friendship in their love relationships than their non-diabetic peers [96], which suggests specific feelings of lower self-worth and self-esteem in social relationships [97].

As regards marital status, both men and women with diabetes are less likely to be married compared with their age-matched controls. Several factors other than diabetes complications, including job discrimination, high medical costs and psychological pressures, are thought to be responsible for this disparity [98].
8. Cognitive function and professional success

Type 1 diabetes appears to be associated with an increased risk of mild neuropsychological dysfunction, although there is controversy over its precise cause and extent [99]. A recent study from Sweden reveals that children who developed diabetes during 1977–2000 had poor school performances compared with their non-diabetic peers [100]. Some studies have shown that impaired cognitive and learning abilities are more common among boys, and in children diagnosed with diabetes during infancy and their preschool years (<5 years of age) [101–103]. Some abilities are more vulnerable to early disease onset, such as attention and processing speed, and have been associated with mild central brain atrophy [104]. In addition, hypoglycaemia has been associated with impaired intellectual abilities such as verbal and full-scale intelligence scores [105,106], while another study [107] reported that only children who had severe hypoglycaemic episodes leading to seizures appeared to score lower on tests of memory, attention, perception and motor skills. In fact, electroencephalography (EEG) abnormalities have been frequently observed in children and adolescents who have frequent episodes of severe hypoglycaemia [108].

Prolonged hyperglycaemia has also been associated with cognitive dysfunction [109]. Behavioural disturbances (overactivity, lack of concentration, negative mood swings) have been reported in children with elevated blood glucose levels of long duration, an effect that has also been observed in adults [110,111]. Indeed, most reports show that children and adolescents with T1DM may have mild cognitive and academic difficulties, which are probably due to the intercorrelation of several factors such as the frequencies of severe hypoglycaemia and DKA, cumulative glycaemic exposures and duration of diabetes [101]. However, maintaining good glycaemic control, especially in children diagnosed at an early age, may protect against cognitive impairment.

Adolescents and young adults with diabetes frequently experience health-related problems that affect their job employment [112]. Among these problems, 19% reported losing their job because of diabetes, 28% were unable to do the job they preferred and 41% had shift-work problems [113]. A minority of patients admit to withholding information about their condition from their employees [114] while, in some cases, work difficulties are associated with their lower self-esteem [112].

9. Quality of life (QoL)

Concerning this important aspect in the care of patients with diabetes, most studies demonstrate a negative effect of diabetes on QoL [115–117], while a few studies have reported no effects [118,119]. The most important determinants of QoL are the absence of psychosocial dysfunction and family conflicts [36,120]. It has been found that the presence of a supportive and emotionally warm parental environment, good family communication, reinforcement strategies by health practitioners and adequate social supports are critical for the improvement of QoL in patients with T1DM [3].

Among the factors affecting QoL in adolescence are increasing age, female gender [121], an increased prevalence of psychiatric and behavioural disorders [122,123], and socioeconomic factors. This means that adolescents from single-parent families and ethnic minority groups have markedly poorer QoL [74,122], which may be attributable to communication problems, and differences in culture and diet.

Some studies suggest a link between QoL and metabolic control, as poor metabolic control has been associated with a greater family burden [121]. However, other studies could find no such association [3,120].

As for the impact of the insulin regimen on adolescents’ QoL, no significant adverse effects with MDI treatments have been reported [121]. With CSII, some studies suggest that it may improve important aspects of health-related QoL by improving metabolic control and lifestyle [69,74].

For these reasons, it has been suggested [121] that specific attention should be paid by primary-care providers (PCPs) to the management of adolescent girls and patients belonging to single-parent families and ethnic minorities. Moreover, PCPs are advised to keep on the lookout for diabetic adolescents with psychosocial problems and to refer them on for psychological or psychiatric evaluation.

10. Smoking, alcohol and drugs

Smoking is an independent risk factor for the development of late diabetic complications [116,124], whereas alcohol consumption has been associated with the presence of delayed hypoglycaemia [125] and an impaired ability to detect hypoglycaemic symptoms [126].

The frequency of smoking among adolescents and young adults with diabetes aged 17–29 years is reported to be 24% [127] whereas, in the younger age group (11–20 years), there is a wide variation in smoking rates across different studies (ranging from 9 to 34%) [2,128].

The overall frequency of alcohol use among adolescents with diabetes (12–20 years) was 40–50% [128,129], indicating that almost half of adolescents with T1DM drink dangerously while, in another study, approximately 50% reported having tried alcohol [130]. The presence of a family history of alcohol use was more frequent among those adolescents who consume alcohol [131].

Studies of substance abuse among adolescents with diabetes are extremely limited and vary from one country to another. The frequency of drug use in adolescents (aged 10–20 years) with diabetes in the US is reported to be 10% [128]. A study from the UK [129] reported that, of 158 adolescents and young adults (aged 16–30 years) with T1DM who attended a diabetes clinic and filled out an anonymous questionnaire, 29% admitted using street drugs. Among these drug-users, 68% used them more than once a month and 72% were unaware of the adverse effects on diabetes. These studies concluded that (self-reported) drug use is common among young adults with T1DM, and may contribute to poor glycaemic control and the more serious complications of diabetes [128,131].
Similar factors have been found to contribute to the initiation of smoking and alcohol consumption in adolescents with diabetes, namely: the presence of psychological disorders (depression and anxiety) [132] and the use of smoking or drinking as a way of coping with treatment difficulties [133] and improving self-image [134]. Also, the frequency of alcohol, tobacco and solvent consumption is reported to be higher in adolescents from the higher social classes compared with those from lower ones [135].

One study found that young people aged 10–20 years with diabetes perceived themselves to be less at risk of adverse health effects associated with risky behaviours, such as smoking, than their peers [128]. This observation highlights the importance of educating adolescents on the deleterious effects of tobacco and alcohol consumption, and of offering alternatives to those who wish to become accepted by their peers.

11. Contraception

It has been reported that 50% of all teenagers aged 15–19 years are sexually active. However, the prevalence of unplanned pregnancy among adolescents with diabetes is no different from that of their non-diabetic peers (4.6% vs 4.2%, respectively), and 3.5% have sexually transmitted diseases (Chlamydia or Trichomonas) [136]. This suggests that adolescent girls with or without diabetes are engaged in less than optimally protected sexual activities, thereby increasing their risk of having an unplanned pregnancy and sexually transmitted infections.

However, pregnant adolescent girls with T1DM are at greater risk of early miscarriage, preeclampsia, fetal distress [137,138] and congenital malformations in their offspring, with a frequency of 6–9% [139,140], which is three to four times higher than that seen in the general neonatal population (2%) [138].

However, intensive diabetes management during pregnancy has been reported to reduce the birth anomaly rate from 10.9 to 1.2% [138]. Thus, for all young women with T1DM who wish to become pregnant, intensified glycaemic control is suggested during the 4 months prior to conception and throughout pregnancy [138]. Also, safe and effective contraceptive methods are essential for those women who wish to have a “planned pregnancy” under optimal conditions [141].

Another problem lies in the choice of an optimal contraceptive method for young women with T1DM, as oral contraceptives are associated with adverse metabolic effects such as changes in blood pressure, carbohydrate metabolism and lipid metabolism [142]. However, previous studies suggest that synthetic oestrogens (mestranol and ethinylestradiol) have few adverse effects, whereas 19-norprogestogens adversely affect metabolism [142]. Thus, oral contraceptives containing less than 50 μg of oestrogen or a weak progestin, such as low-dose norethindrone, are preferable [142].

So, although gynaecologists have limited experience of contraception in young women with T1DM, oral hormonal contraceptives appear to be the first choice for contraception in adolescents and women with or without diabetes [142–144], while the preferred contraceptive method for young women with T1DM who smoke is the condom [143]. Nevertheless, even if adolescents use oral contraception as their chosen method, the use of condoms is necessary to prevent sexually transmitted diseases.

Thus, PCPs need to inform young women and adolescents with T1DM of both the appropriate contraceptive methods and the importance of maintaining tight glycaemic control before conception.

12. Therapeutic interventions in psychosocial disorders

Young people with diabetes and their families are often referred by PCPs to psychiatrists and psychologists for behavioural management services. The problems are usually associated with treatment compliance and diabetic control, social and coping skills, and diabetes-related anxiety and stress management.

13. Detecting high-risk adolescents

The first step towards successful intervention in patients who are non-compliant with treatment is to identify the responsible risk factors. These are either demographic or behavioural, and may be related to either the child or the family.

Child-related risk factors include [61,145]:

- older age (mid-adolescence);
- presence of other health problems (asthma, eating disorders);
- poor school attendance;
- learning disabilities;
- emotional and behavioural disorders, such as risk-taking behaviours;
- depression and/or anxiety;
- unsatisfactory responsibility for treatment tasks.

Family-related risk factors include [62,146]:

- single-parent family;
- chronic physical or mental health problems (substance abuse in parents or other close family member);
- recent major life change for parent (job loss, death in the family);
- lack of adequate health insurance;
- complex child-care arrangements;
- health or cultural or religious beliefs that make it difficult to follow the treatment plan;
- a parent with diabetes who might have an outdated or inappropriate concept of care for a child with diabetes, and/or anxiety or depression related to personal diabetes care affecting the ability to learn and apply the recommended care for the child;
- high levels of family conflicts;
- poor family communication and problem-solving skills.

14. Prevention and early interventional strategies

If a child or family is identified as being at high risk of non-compliance with treatment, they should be scheduled for
an outpatients follow-up with a psychiatrist or psychologist. A number of interventions have been developed that offer support for improving treatment compliance. Behavioural contracts involve negotiation between parents and teenagers with the aim of reaching an agreement that will provide positive reinforcement for achieving treatment goals [147]. Self-monitoring behaviours, learning problem-solving skills, and a multisystem therapy that involves the individual, family, peers, school and medical team all appear to increase compliance with therapy and to improve metabolic control [148].

Important behavioural interventional plans should always include the family of the patient with T1DM. The Joslin group has conducted a series of interventional studies [149–151] using psychoemotional education and increased supportive contact to enhance parental involvement in diabetes care, encourage regular clinic attendance and reduce diabetes-related family conflicts. Although these studies reported success in achieving these goals, they nevertheless had a variable impact on metabolic control and no significant effect on the patients’ QoL [150].

As effective disease-specific social and coping skills are crucial for treatment compliance, these have been investigated in a number of studies. Their findings show that interventions improved patients’ treatment compliance and self-monitoring, with subsequent improvements in glycaemic control [147,152] and a decreased negative impact of the disease on QoL [153]. Other interventions have targeted anxiety and stress in children with diabetes [154]. Some studies used biofeedback-assisted relaxation [155] or progressive muscle relaxation [156] to lower blood glucose levels. These interventions reduced stress in the participants, but failed to improve metabolic control or treatment compliance.

The above-mentioned studies reveal that stress-management treatments are useful only in combination with other interventions that more directly target behavioural problems [154,157].

Multisystem therapy involves, in addition to the patient and his family, the patient’s school, peers and medical team. School personnel need to be aware and supportive of the child’s potential medical and psychosocial needs, and should be properly educated in how to identify and treat hypoglycaemia. Also, school staff members should keep on the lookout for signs of depression, anxiety [158] and risk-taking behaviours (use of tobacco, drugs, alcohol and sex) [99].

Attempts have been made to involve patients’ peers in diabetes management during adolescence. In one study [159], a significant improvement in knowledge of diabetes in both peers and adolescent patients with diabetes was observed, as well as a decline in diabetes-related family conflicts.

Regarding the role of PCPs, five important contributions have been suggested by Wysocki et al. [3]:

- PCPs should regularly assess the need for psychiatric or psychological services in patients and their families, and refer patients to providers who are familiar with the psychological aspects of paediatric medical conditions;
- PCPs should advocate health promotion on a community level for obesity prevention, and opportunities for exercise and sports. They should facilitate the in-school management of diabetes and also help in the transition from paediatric to adult care;
- PCPs should counsel patients and their families on the latest advances in medical care, and also seek continuing education on the psychological aspects of diabetes.

15. Conclusion

Adolescents with diabetes have an increased risk of developing eating disorders, depression and substance abuse, leading to deterioration of diabetic control. Those at particularly increased risk are female adolescents with family problems and coexistent psychiatric disorders. In addition, the presence of T1DM contributes to family conflicts and problems with parent–child relationships, poor school performance, employment difficulties and poor QoL. However, the contribution of friends and family to improvement of metabolic control and to emotional support is crucial. Insulin pump therapy appears to improve patients’ metabolic control and lifestyle. However, PCPs play an important role in identifying those adolescents with diabetes who have an increased risk of psychosocial problems, and in closely following them up in terms of glycaemic control and referral to specialist support. PCPs should also cooperate with the patient’s family and school personnel for identification of risk-taking behaviours, and the proper management of the medical and psychological needs of adolescents with diabetes.

16. Conflicts of interests

There are no conflicts of interests related to the above study.

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