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ACTing for Adolescent Diabetes

Evaluating the Impact and Acceptance of a Group-Based Acceptance and Commitment Therapy Intervention for Adolescents with Type 1 Diabetes

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ABSTRACT

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The aim of this research was to evaluate the impact and acceptance of a group-based acceptance and commitment therapy (ACT) intervention for adolescents with type 1 diabetes who were not meeting their treatment targets. Adolescents aged 12-16 (n = 78) at the diabetes outpatient clinic were allocated to intervention and control groups. Study I explored the pre-intervention data from both intervention and control groups (n = 65) and investigated the role of psychological flexibility in relation to glycemic control (HbA1c) and quality of life. The results showed that a higher level of diabetes-related psychological flexibility and mindfulness and acceptance skills were associated with better glycemic control, better quality of life, and lower levels of depression and anxiety symptoms. Diabetes-related psychological flexibility mediated the relationship between glycemic control and depressive symptoms as well as quality of life. Study II explored the impacts of the ACT-group intervention. HbA1c levels, diabetes-related psychological flexibility, acceptance and mindfulness skills, symptoms of depression and anxiety, and quality of life were monitored. Results showed that, compared to the control group (n = 36), the intervention group (n = 36) showed significantly larger changes in glycemic control, diabetes-related psychological flexibility, and symptoms of anxiety. Study III explored the acceptance and perceived benefits of the intervention using both quantitative and qualitative data from those adolescents who completed the intervention (n = 28) and their parents. Based on the result, the intervention was well accepted, and most of the adolescents and their parents were satisfied with the intervention. Themes that arose from the experiences of the adolescents included, for example, increased motivation for treatment and improved attitude toward diabetes. Among the parents, themes such as positive changes in adolescents' mood, better attitude toward diabetes, and increased motivation for treatment emerged. Those who improved more regarding their glycemic control were older and had higher HbA1c at the start, and they reported greater changes in diabetes-related psychological flexibility. Based on these findings, an ACT-based group intervention is suitable for this group and could increase treatment compliance.

Keywords: Acceptance and commitment therapy, type 1 diabetes, psychological flexibility, adolescence

TIIVISTELMÄ (ABSTRACT IN FINNISH)

Tämän tutkimuksen tavoitteena oli arvioida ryhmämuotoisen hyväksymis- ja omistautumisterapiaintervention (HOT) vaikutuksia ja hyväksyttävyyttä tyypin 1 diabetesta sairastavilla nuorilla, joiden hoitotasapaino oli tavoitetasoa heikompi. Tutkimusta varten kehitettiin viiden kerran HOT-menetelmiin perustuva ryhmäinterventio. Tutkimukseen rekrytoitiin diabetespoliklinikan 12–16-vuotiaita nuoria (n = 78) ja heidät satunnaistettiin interventio- ja tavanomaisen hoidon ryhmään. Osatutkimuksessa I tutkittiin psykologisen joustavuuden yhteyttä pitkäaikaissokeritasoon (HbA1c) ja elämänlaatuun ennen interventiota. Tietoa kerättiin sekä interventio että tavanomaisen hoidon ryhmiltä (n = 65). Tulokset osoittivat, että parempi diabetekseen liittyvä psykologinen joustavuus sekä paremmat läsnäolo- ja hyväksyntätaidot olivat yhteydessä parempaan pitkäaikaissokeritasoon, parempaan elämänlaatuun ja vähäisempiin masennus- ja ahdistuneisuusoireisiin. Osatutkimus II:n tulokset osoittivat, että tavanomaiseen hoitoon (n = 36) verrattuna interventioryhmässä (n = 36) havaittiin merkitsevästi suurempia muutoksia pitkäaikaissokeritasapainossa, diabetekseen liittyvässä psykologisessa joustavuudessa sekä ahdistuneisuusoireissa. Osatutkimuksessa III tutkittiin intervention hyväksyttävyyttä ja hyötyjä kvantitatiivisin ja kvalitatiivisin menetelmin niiltä nuorilta, jotka suorittivat intervention loppuun (n = 28) ja heidän vanhemmiltaan. Enemmistö nuorista ja vanhemmista ilmoitti olevansa tyytyväisiä ryhmään. Nuorten kokemuksista nousivat esille mm. lisääntynyt hoitomotivaatio ja myönteisempi suhtautuminen diabetekseen. Vanhemmat toivat esiin mm. nuoren myönteiset mielialan muutokset, myönteisemmän suhtautumisen diabetekseen ja lisääntyneen hoitomotivaation. Nuoret, jotka olivat iältään vanhempia, joiden pitkäaikaissokeri oli heikompi alussa, ja joilla oli suurempia myönteisiä muutoksia diabetekseen liittyvässä psykologisessa joustavuudessa, hyötyivät ryhmästä eniten. Näiden havaintojen perusteella HOT-ryhmäinterventio on vaikuttava ja soveltuu hyvin käytettäväksi nuorten tyypin 1 diabeteksen hoidossa. Psykologisen HOT-ryhmäintervention lisääminen tavanomaiseen diabeteksen hoitoon voisi parantaa nuorten hoitomyönteisyyttä.

Avainsanat: hyväksymis- ja omistautumisterapia, tyypin 1 diabetes, nuoret, psykologinen joustavuus

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FIGURES

TABLES

LIST OF ORIGINAL PUBLICATIONS

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Taking into account the instructions given and comments made by the co-authors, the author of the present thesis participated in designing the research plan, planning and execution of the intervention and collecting the data. The author also contributed to the statistical analysis and was the main author of the three publications.

CONTENTS

1 INTRODUCTION

1.1 Type 1 diabetes

Type 1 diabetes is a severe, chronic autoimmune illness that leads to the destruction of insulin-producing pancreatic beta cells, resulting in a reduced or negligible production of insulin by the pancreas. Insulin is vital for enabling the body to facilitate the entry of sugar (glucose) into cells for energy production. Type 1 diabetes is commonly observed in children, adolescents, and young adults. While its cause or causes remain unidentified, it is believed that a combination of genetic susceptibility and environmental factors contribute to the development of type 1 diabetes (Roglic, 2016). The most common type of diabetes, type 2 diabetes, can also be detected in childhood and adolescence but occurs mainly in adulthood. In type 2 diabetes, the body cannot utilize insulin effectively; that is, it becomes insulin resistant.

The prevalence of type 1 diabetes in Finland is the highest in the world (Norris et al., 2020). The annual rate was 52.2 per 100,000 children under the age of 15 between 2015–2018 (Knip, 2021; Parviainen et al., 2020. In Finland, nearly one in every 100 person is affected by type 1 diabetes, and one third of patients are diagnosed under the age of 15. In 2017, 493 children (33%) and 1,011 adolescents and adults (67%) were diagnosed with type 1 diabetes, and, at the moment, nearly 4,000 0–14-year-old children are living with the disease (Knip, 2021).

The aim of diabetes management is to maintain normal or near-to-normal hemoglobin A1c (HbA1c) levels. HbA1c is a commonly used marker of glycemic control, and refers to glycated hemoglobin (A1c), which identifies average plasma glucose concentrate. The treatment target for children is currently an HbA1c of < 7.0% (53 mmol/mol) (de Bock et al., 2022). Earlier, at the time of the start of the data gathering for this study, the treatment target was HbA1c < 7.5% (58 mmol/mol). Optimal diabetes management lowers the risk of short-term

complications, such as hypoglycemia, hyperglycemia, and diabetic ketoacidosis, and longer-term complications, e.g., retinopathy, neuropathy, and nephropathy (The DCCT/EDIC Study, 2016). The long-term consequences of suboptimal glycemic control comprise both microvascular and macrovascular complications that increase morbidity and mortality for persons with type 1 diabetes (American Diabetes Association, 2019).

Type 1 diabetes is often challenging to manage, as optimal treatment requires intensive daily management including checking blood glucose levels several times a day, several insulin injections or the use of an insulin pump, close attention to nutrition and physical activity, and regular appointments to diabetes clinics to monitor risk and treatment for medical complications (Hood et al., 2009).

Apart from the physical impacts, an inability to reach the ideal hemoglobin level can contribute to heightened psychological pressure, potentially resulting in negative emotional responses and critical evaluation from medical professionals and family members. This situation may also instigate a strong feeling of defeat and foster resentment in managing diabetes (Sandham & Deacon, 2023; Ventura et al., 2019).

1.2   Type 1 diabetes in adolescence

Adolescence represents a pivotal period characterized by various developmental challenges. Beyond the typical challenges of adolescence (related to, among other things, independence, and identity formation) young individuals grappling with chronic illnesses encounter non-normative difficulties, including the integration of a persistent health condition into their daily lives (Oris et al., 2016). Adolescents, as well as their parents, may perceive diabetes self-management as a burdensome task (Hilliard et al., 2013).

The primary objective of diabetes care for children and adolescents is to attain an optimal metabolic balance to prevent or minimize the risk of acute and long-term complications. More precisely, successful adaptation involves keeping blood glucose levels close to normal while minimizing adverse effects on the quality of life related to health (Rybak et al., 2017; Whittemore et al., 2010).

However, in adolescence, metabolic control tends to deteriorate, and it has been found that only 17% of adolescents meet the HbA1c treatment target of < 7.0% (American Diabetes Association, 2021). This is due in part to physiological changes and partly to psychological reasons. Physical changes linked to growth often give rise to increased insulin resistance and the need for changes in treatment, whereas psychological reasons include elements such as weak problem-solving skills, tendencies towards adolescent rebellion, and the desire to belong to peer groups without standing out (Anderson, 2003; Insabella et al., 2007). The desire for peer acceptance can result in the avoidance or postponement of self-management behaviors in social settings, aiming to avoid attention and minimize their diagnosis (Chiang et al., 2018; Grossoehme et al., 2020).

Adolescents also need to exercise their independence, but self-management of diabetes requires being dependent on parents and health care professionals.

Type 1 diabetes introduces numerous additional demands for adolescents, encroaching upon various aspects of their lives. Managing diabetes requires a significant self-discipline and is frequently perceived as particularly stressful (Luyckx et al., 2010). In Western countries, children and adolescents have benefited from technology (such as the use of sensors and insulin pumps), allowing more flexible treatment and a more normal life, but the psychological challenges remain (Speight, 2013; Stahl-Pehe et al., 2014): improved technology does not change the challenge of dealing psychologically with the choices presented by the illness, such as insulin dosage and reactions to high and low blood glucose levels (Sivertsen et al., 2014). Despite recent technological advances in diabetes care, maintaining an optimal level of glycemic control during adolescence continues to pose a challenge (Gregory et al., 2022).

It is notable that poor adjustment to type 1 diabetes in adolescence tends to persist into young adulthood (Insabella et al., 2007; Wysocki et al., 1992). The Diabetes Control and Complications Trial/Epidemiology of Diabetes Interventions and Complications Study (DCCT/EDIC) (2016) demonstrated that improved glycemic control during adolescence correlates with a reduced risk of developing complications later in life—even if that level of control is not sustained subsequently According to the International Society for Pediatric and Adolescent Diabetes (ISPAD) Clinical Practice Consensus Guidelines (2022) there is a need for interventions to help adolescents with diabetes adapt to self-management activities (de Wit et al., 2022).

1.3 Psychological well-being of adolescents with type 1 diabetes

Several studies of adolescents with type 1 diabetes estimate that the rates of psychological symptoms are elevated in this population (Akbarizadeh et al., 2021; Buchberger et al., 2016; Butwicka et al., 2015). Increased rates of anxiety, eating disorders, and depression (Kongkaew et al., 2014) have been reported among adolescents with type 1 diabetes. However, the results regarding psychological symptoms are mixed. According to the meta-analysis by Reynolds and Helgeson (2011), adolescents with type 1 diabetes showed only slightly elevated levels of symptoms of depression and anxiety, and some studies did not find any differences between adolescents with and without type 1 diabetes (Sivertsen et al., 2014).

The relationship between depression and glycemic control is reciprocal: inadequate glycemic control poses a risk for depression, while depression can have a detrimental impact on glycemic control (Lustman & Clouse, 2005). According to Schmitt et al. (2021) depression is associated with poorer diabetes self-care, which in turn results in less favorable glycemic outcomes. Adolescents exhibiting depressive symptoms may encounter challenges in initiating and adhering to diabetes management tasks, as well as maintaining confidence in

their efficacy (McGrady et al., 2009). Moreover, anxiety has been linked to glycemic control as well (Buchberger et al., 2016). According to the ISPAD Clinical Practice Consensus Guidelines 2022 (Gregory et al., 2022), mental health issues in people with type 1 diabetes can potentially lead to early complications and significantly premature mortality, often through the interplay between mental health symptoms and insulin mismanagement. Additionally, the ISPAD guidelines recommend that mental health treatment should ideally be overseen by clinicians experienced in diabetes care.

Moreover, distress related to diabetes is common (Anderson, 2011). Diabetes distress stands for the negative feelings arising from living with diabetes and the burden of self-management and is experienced by around one-third of adolescents with type 1 diabetes (Hagger et al., 2016). During adolescence, distress related to diabetes can result in irregular use of insulin and other self-care practices, leading to heightened glycemic variability (Gregory et al., 2022). Gregory et al. (2022) also emphasize the need for caution to ensure that diabetes-related distress, concerning the challenges posed by type 1 diabetes, is not misinterpreted as depression, underlining the importance of thorough evaluation for accurate diagnosis and treatment. Additionally, the early stages of diagnosis often exhibit a high incidence of depressive symptoms, which typically during the adaptation process (Gregory et al., 2022).

Furthermore, changes in body habitus during adolescence can also have a negative impact on body image, potentially triggering the onset of eating disorders and insulin omission for weight loss, consequently exacerbating glycemic instability, and heightening the risk of complications (Gregory et al., 2022). According to Cecilia-Costa et al. (2018), disordered eating behaviors are common in adolescents with type 1 diabetes and are associated with poor glycemic control, diabetes complications, and early mortality.

Although adolescents experience distress about their illness, they still assess their overall quality of life comparably to their peers and express high levels of life satisfaction (Nieuwesteeg et al., 2012; Williams et al., 2009). A recent study by Bratke et al. (2022) found that health related quality of life reported by children, adolescents, and their parents was generally high. Also, a German study found that adolescents with type 1 diabetes evaluated their quality of life lower than their healthy peers only in quality of life concerning family (Stahl-Pehe et al., 2014). It has been shown that family conflicts around diabetes management negatively affect children's quality of life more than the intensity of treatment (Rybak et al., 2016; Whittemore et al., 2010). Still, the findings about the quality of life of adolescents with type 1 diabetes are not consistent. There are also studies reporting weakened quality of life for children and adolescents with type 1 diabetes (Kalyva et al., 2011; Suji & Nawale, 2020). A vast international study by Anderson et al. (2017) found that diabetes-specific health related quality of life (D-HRQOL) was significantly related to HbA1c; the lower the blood glucose levels, the better the health-related quality of life (Anderson et al., 2017). Also, Garcia et al. (2023) found that children and adolescents with better HbA1c levels rated their quality of life higher.

1.4 Parents' role in supporting their children with type 1 diabetes

Support from family members is vital for adaptation to positive diabetes-related behaviors (Wennick et al., 2009). Treatment of type 1 diabetes requires a higher degree of behavioral regulation than is normal for children of similar age (Wennick et al., 2009), and parents play an important role in treatment adherence not only through their direct involvement in diabetes management but also through the quality of their general parenting style (Goethals et al., 2017). In adolescence, the role of the parent changes from direct involvement and monitoring to acting as backup support (Goethals et al., 2017; Hilliard et al., 2014). This shift in self-care responsibility from parent to child is a significant challenge in adolescent diabetes care (Markowitz et al., 2015) and can be demanding (Wiebe et al., 2014). There can be disagreements between parents and adolescents over independence and responsibilities, and parents can experience many worries, including conflicts with their child about type 1 diabetes self- management and concerns about their child's safety (Hessler et al., 2016; Streisand et al., 2005). Parents may feel ambivalent since their own responsibility increases because of the illness, yet there is a need to hand over this responsibility to the child (Wennick et al., 2009). Because parents of children with type 1 diabetes are deeply involved with their child's care, there is a danger of becoming overprotective and controlling (Jubber et al., 2013), making independence a challenge for the adolescent.

Also, diabetes-specific family conflict is associated with poorer glycemic control and reduced quality of life in teenagers (Gregory et al., 2022; Shorer et al., 2011). Furthermore, parents are faced with the task of balancing their child's diabetes-related responsibilities with their regular parenting duties (Olinder et al., 2022). Health care professionals are challenged to provide diabetes education that enhances the family's knowledge and understanding of the illness, and its treatment, while also aiding them in adapting to the effects of diabetes management in their daily routines.

Nonetheless, the impact of having a child with diabetes on parents' psychological well-being is not solely negative: parents also report positive facets, including enhanced family closeness, better family health practices, and improvements in their child's psychosocial well-being (Helgeson et al., 2012; Mellin et al., 2004). Iskander et al. (2015) found in their study with families with children with type 1 diabetes, that family communication changed in unexpected and positive ways during the transition to adolescence.

1.5 Interventions to promote motivation for self-management and well-being among adolescents with type 1 diabetes

Behavioral factors and motivation are widely recognized as crucial components in the management of diabetes. Several psychological interventions, such as coping skills training, family-based approaches, motivational interviewing, cognitive behavioral therapy (CBT), psychoeducation, and multisystem therapy have been investigated for their efficacy in treating adolescents with type 1 diabetes. These programs have demonstrated that psychological interventions can enhance patients' control of glycemic levels (Aljawarneh et al., 2020) and contribute to overall well-being, psychological adaptation, quality of life, and self-efficacy (Resurrección et al., 2021). When using group interventions, the advantages of peer-support seem to strengthen the benefits (Titoria et al., 2022).

According to Barry-Menkhaus et al. (2020), reviews and meta-analyses indicate that psychosocial interventions are effective in improving diabetes self-management; however, effect sizes regarding glycemic control are generally small (< 0.20). Meta-analysis by Hood et al. (2010) studied the impacts of interventions with adherence-promoting components in pediatric type 1 diabetes on glycemic control and found that the mean effect size for pre- to post-treatment change for the intervention versus control group comparison was 0.11 (95% CI −0.01 to 0.23). According to Hood et al. (2010), multicomponent interventions targeting both the direct and indirect processes involved in diabetes management have more potential than interventions targeting only a direct, behavioral process (e.g., increase in blood glucose monitoring frequency). For example, the study by Grey et al. (2000) had a medium effect size (0.49) for change in glycemic control in their coping skills training program for adolescents with type 1 diabetes. This program trained adolescents with type 1 diabetes to increase their ability to cope with problems that they faced on a day-to-day basis and to become more effective in achieving therapeutic goals. According to Hood et al. (2010), this inclusion of diabetes-specific social scenarios may have helped the development of general coping skills. This intervention, which consisted of six group sessions and monthly follow-up, included skills building related to social problem solving, cognitive behavior modification, and conflict resolution.

There is some evidence that self-compassion-focused interventions are effective in diabetes management in adults. Self-compassion refers to treating oneself with kindness during difficulties, recognizing shared human experiences, and maintaining mindful awareness of painful thoughts and feelings, rather than being overly identified with them (Neff, 2003). According to a review study by Sandham and Deacon (2023), self-compassion was associated with improved outcomes in the management of diabetes as regards regimen adherence and HbA1c-levels and in various psychological well-being domains. Studies have revealed that self-compassion is a significant predictor of enhanced glycemic control and adherence to treatment regimens in adolescents with type 1 diabetes, with associated outcomes tied to a diminished risk of short- and long-term health

complications. Additionally, impaired self-soothing (the ability to comfort and calm oneself in times of distress, anxiety, or emotional discomfort) was found to serve as a mediator in the correlation between emotional distress and suboptimal adherence to diabetes management routines (Jackson, 2018). Self-compassion is closely related to psychological flexibility: Kılıç et al. (2021) identified a negative association between self-compassion and psychological inflexibility in their study with people with type 2 diabetes: when individuals showed an increased level of self-compassion, they displayed less psychological inflexibility or were more psychologically flexible.

1.6   ACT and psychological flexibility

ACT, an intervention approach rooted in behavior analysis, falls under the category of third-wave cognitive-behavioral therapies—a newer generation of functional contextual psychotherapy approaches (Hayes et al., 1999, 2006). The primary objective of ACT is to foster psychological flexibility (Hayes et al., 2006), a concept that refers to an individual's ability to accept one's own difficult thoughts and feelings while actively pursuing a meaningful life in accordance with their personal values (Hayes et al., 2013). Psychological flexibility is regarded as crucial for health because it enables individuals to utilize their thoughts, feelings, and behaviors to navigate various situations to attain optimal outcomes (Kamody et al., 2018; Kashdan & Rottenberg, 2010). According to Doorley et al. (2020), psychological flexibility is particularly useful when challenges that produce distress arise during goal pursuit. For example, a psychologically flexible adolescent with type 1 diabetes would acknowledge and accept his/her difficult emotions related to diabetes but still aim to live his/her life according to his/her own values, in contrast to trying to avoid emotions and situations connected to taking care of diabetes, resulting in problems with its self-management.

Psychological flexibility is established through six core processes: values, committed action, self as a context, defusion, acceptance, and contact with the present moment (Hayes et al., 2006). Values refer to the chosen qualities of purposive action that cannot be obtained as an object but can be instantiated moment by moment; they are not to be reached but are instead used to guide behavior about the best choices to take in life. For example, adolescents could be encouraged to identify domains that they experience as personally relevant, including the domain of physical self-care (diabetes management). Committed action refers to the patterns of effective action linked to chosen values that lead to value-directed living. Adolescents with diabetes could choose relevant actions and goals that align with their life values. In the domain of physical self-care, this would include goals specifically related to diabetes management behaviors, such as taking insulin when out with friends even though doing so would require taking a small break from what they are doing. Committed actions would also encompass work with internal and external barriers. Self as a context refers to the

"observing self," a separate being experiencing thoughts, feelings, and behaviors, but not being dominated or defined by them. Instead of identifying with the sickness and taking it to represent reality (conceptualized self), an adolescent could be encouraged to see him/herself from an observer perspective: the You that is ever present and distinct from all thoughts, emotions, and sensations. Defusion is used to weaken the link between the verbal content of feelings and thoughts and their function to achieve neutral perception of these internal events (Halliburton & Cooper, 2015). Instead of fusing with thoughts such as "People think I'm different when they see me check my blood sugar," or "I won't have a normal life because of my illness," the adolescent with diabetes could be encouraged to view these painful thoughts as a verbal event, as "just a thought," and not as something one must adhere. Acceptance is the opposite of experiential avoidance and involves accepting one's private experiences stemming from personal history without striving to alter their frequency or form. Adolescents would learn to simply observe each (painful) thought as it occurs and be willing to experience each emotion and physical sensation that emerges. And finally, contact with the present moment refers to mindfulness; that is, being mindfully and non-judgmentally aware of whatever is happening in the moment (Hayes et al., 2006). Adolescents with diabetes could be encouraged to notice the thoughts, emotions, and physical sensations that occur prior to, during, and after, for example, activities such as eating, exercising, blood glucose monitoring, and administering insulin injections.

Hadlandsmyth et al. (2013) suggested that adolescents with diabetes who become overly attached to their private experiences and consequently engage in experiential avoidance may attempt to regulate their private events through behavioral strategies that may not be beneficial in the long run. For instance, an adolescent with diabetes may become fused with thoughts like "People think I'm different when they observe me checking my blood sugar". To alleviate these distressing thoughts, they might adopt unhealthy habits such as avoiding insulin injections or abstaining from regular blood-glucose checks. Figure 1 illustrates the processes of psychological flexibility and inflexibility and how these processes would present in the life of an adolescent with type 1 diabetes.

Contact with the Present Moment
Ability to fully engage with the present moment, without being distracted by the thoughts of the past or future.
"I notice the thoughts and emotions I am having whilst I'm taking care of my diabetes"

Acceptance
Willingness to experience difficult thoughts and emotions without trying to control or avoid them.
"It's OK for me to feel mad or upset about having diabetes. "

Defusion
Being able to separate ourselves from our thoughts, viewing them as passing mental events rather than objective truths.
"I notice that I am having a thought that is telling me I´m different because of my diabetes."

Values
Being able to identify the domains as personally meaningful, including physical self-care (diabetes management).
"I know what is important to me in my life."

Committed Action
Engaging in behaviors that are in line with personal values.
"I am taking care of my diabetes because my health is important to me, even though it requires work."

Psychological Flexibility

Self as Context
Being able to view ourselves from a broader perspective, recognizing that we are more than just our thoughts, feelings and experiences.
"I am more than my illness."

Dominance of the Conceptualized Past and Feared Future
"I don't pay attention to what I'm doing, as I worry about the future, or am stuck with the thoughts about past experiences."

Experiential Avoidance
"I push away my difficult feelings towards diabetes and avoid treatment, as it makes me feel bad."

Cognitive Fusion
"People think I'm different when they see me check my blood sugar, and I believe it."

Lack of values
"I let others define what is meaningful to me"

Inaction, Impulsivity, or Avoidant Persistence
"My health is important to me, but I don't do actions towards good treatment as other stuff gets in the way".
"My diabetes gets in the way of living a good and meaningful life. "

Psychological Inflexibility

Attachment to the Conceptualized Self
"I will never be able to take good care of my diabetes."
"Diabetes defines how my life is."

FIGURE 1   Domains of psychological inflexibility and flexibility (Hayes et al., 2006) and examples of how these domains could show in an adolescent's life as they relate to diabetes (examples by the author).

1.7 ACT for health-related conditions and well-being

ACT has demonstrated successful application in the treatment of various health conditions, including obesity (Lillis & Kendra, 2014), chronic pain (Hughes et al., 2017; Wicksell et al., 2009), epilepsy (Lundgren et al., 2006), and cardiovascular disease (Rashidi et al., 2021). It has also shown promise in the treatment of adults with type II diabetes (Gregg et al., 2007; Sakamoto et al., 2021). In a systematic review, Sakamoto et al. (2021) concluded that ACT interventions may lead to a reduction in glycated hemoglobin levels and an enhancement in self-care ability and acceptance among individuals with type 2 diabetes. Similarly, Ngan et al. (2021) determined that mindfulness- and acceptance-based approaches could potentially alleviate distress and lower HbA1c levels in adults.

A growing body of research has been employing ACT among children and adolescents (see Petersen et al. 2024). Also, ACT-based group interventions have been used with children and adolescents (see Fang & Ding, 2020; Livheim et al., 2015; Takahashi et al., 2021). ACT interventions for adolescents have exhibited favorable effects on quality of life, psychological symptoms, and psychological flexibility in general populations (Swain et al., 2015). Greco and Hayes (2008) conducted a study with a sample of over 1,300 children and adolescents and found that psychological inflexibility was associated to maladaptive outcomes in adolescents, including heightened self-reported anxiety, somatic complaints, problematic behaviors, and diminished quality of life. Ciarrochi et al. (2011) identified a connection between psychological flexibility and emotional well-being as well as prosocial skills in adolescents aged 14 to 16. Also, a study by Lappalainen et al. (2021) suggested that adolescents who exhibited more avoidance of cognitive fusion and unpleasant thoughts and feelings reported lower levels of satisfaction with life and more depressive symptoms. Also in illness specific populations, psychological flexibility has been demonstrated being important for well-being; for example, in a study by Beeckman et al. (2019), psychological flexibility was associated with improved functioning in adolescents with juvenil idiopatic arthritis (chronic joint inflammation).

1.8 ACT and type 1 diabetes

Some support exists for the use of ACT with type 1 diabetes in adult populations. For example, Bendig et al. (2021) examined adults with both type 1 and type 2 diabetes in their mobile-based ACT intervention and reported a decrease in diabetes distress levels. In their study, Merwin et al. (2021) implemented an ACT intervention that integrated individual in-person sessions with a mobile application for adults with type 1 diabetes and eating disorders. Their findings indicated increased psychological flexibility with diabetes-related thoughts and emotions, as well as reduced hindrances and greater progress in the pursuit of personal values. They found large effects for change in eating disorder symptoms,

diabetes self-management, and diabetes distress from baseline to treatment end (Cohen's d = .90–1.79), change in HbA1c was statistically non-significant. A recent study by Somaini et al. (2023) with adults with type 1 diabetes showed that a web-based ACT intervention had a positive effect on participants' mood, anxiety, and physical activity, and enhanced their psychological flexibility and diabetes-specific well-being.

Attention has been paid to how acceptance of thoughts and emotions related to diabetes is connected to quality of life and glycemic control among people with type 1 and 2 diabetes (Misra & Lager, 2008; Richardson et al., 2001). The results of these studies suggest that high acceptance is connected to lower HbA1c values and better quality of life. Weijman et al. (2005) reported that a diabetes avoidance coping style was associated particularly with infrequent blood glucose monitoring and a high sense of being burdened with blood glucose monitoring. Similarly, studies suggest that adolescents with diabetes who use avoidant coping styles experience greater level of diabetes-specific distress, are less likely to adhere with their treatment regimens, and have poorer glycemic control (Iturralde et al., 2017).

To date, a limited number of ACT-based studies have been conducted on children and adolescents with type 1 diabetes. Moghanloo et al. (2015) found that ACT was effective in reducing depression and feelings of guilt and in increasing well-being in 7–15-year-old children with type 1 diabetes, while Moazzezi et al. (2015) showed that ACT was effective in reducing perceived stress and increasing health-specific self-efficacy in 7–15-year-old children with type 1 diabetes.

Hadlandsmyth et al. (2013) suggested that problems in the treatment of adolescents with type 1 diabetes could be related to psychological inflexibility, especially experimental avoidance and defusion, and that ACT would be a beneficial method for increasing psychological flexibility. In accordance with this, avoidance of diabetes-related thoughts (e.g., "I am different") and feelings has been shown to be related with poorer diabetes management (Weijman et al., 2005).

Overall, the findings from prior research imply that adolescents who are struggling with diabetes management would benefit from enhancing their psychological flexibility skills. Given that type 1 diabetes imposes significant demands on the daily routines of adolescents and their families, it becomes imperative to explore avenues that can assist adolescents in effectively coping with their condition.

Table 1 describes the studies found in the literature that have used ACT with type 1 diabetes. Studies with type 2 diabetes are not included in the table. Also excluded from Table 1 are those studies which, though conducted with people with type 1 diabetes, had research targets other than diabetes management, such as addressing the effects of ACT interventions on anxiety, depression, or other psychological variables (Hadiyan, 2018; Moghanloo, 2015; Najaf Abadi Maryamm, 2016). For example, Moghanloo's (2015) study showed that ACT treatment was effective on variables of depression, psychological well-being, and feelings of guilty in 7–15-year-old children with diabetes. Treatment

protocols and conceptualizations (Amsberg et al., 2018; Hadlandsmyth et al., 2013; Lindholm Olinder et al., 2015) have also been excluded.

TABLE 1   Research on ACT among children, adolescents, and adults with type 1 diabetes.

Authors Number of persons	Study aim	Method	Main conclusion
Studies concerning children and adolescents with type 1 diabetes			
Barker, 2016 n = 9	To assess the acceptability and effectiveness of using technology to deliver ACT, and to analyze the experiences of an ACT based app for young people with type 1 diabetes.	A systematic review and a framework analysis	ACT-based application was well accepted and helpful to adolescents with type 1 diabetes
Kamody et al., 2018 n = 162	To establish individual variations of factors to derive profiles of psychological flexibility and examine their relations to the adaptation of glycemic control and health-related quality of life among youth with type 1 diabetes.	Latent profile analysis	Adolescents in High Acceptance & Adherence/Low Stress group displayed significantly higher health-related quality of life and lower HbA1c compared to other groups of adolescents.
Moazezzi, 2015 n = 40	To determine the impact of ACT treatment on perceived stress and health-related self-efficacy among seven to fifteen-year-old children with type 1 diabetes.	A clinical trial with pre-test and post-test design with control group	The ACT treatment decreased stress and increased health-related self-efficacy.
Studies concerning adults with type 1 diabetes			
Bendig et al., 2021 n = 42	To evaluate the feasibility of an ACT based internet intervention for diabetes distress in people with diabetes type 1 or type 2.	A randomized controlled feasibility trial	57% of participants dropped out prior to full treatment completion. There was reduced diabetes distress in the intervention group.

Authors Number of persons	Study aim	Method	Main conclusion
Biglari et al., 2022* n = 36	To investigate the efficacy of ACT treatment on the cognitive fusion and self-care behaviors of students with type 1 diabetes.	A quasi-experimental study with pretest and posttest, with control group design	ACT treatment had significant effect on the cognitive fusion and self-care behaviors of students with type 1 diabetes.
Merwin et al., 2021 n = 28	To examine the acceptability and feasibility of an ACT intervention, and its effects on psychological flexibility, eating disorder symptoms and diabetes management.	A pilot open trial	Treatment was acceptable and feasible, and increased psychological flexibility with diabetes-related thoughts/feelings, and lessened obstruction and improved progress in pursuing personal values. Large effects for change were reported in eating disorder symptoms, diabetes self-management, and diabetes distress from baseline to end-of-treatment.
Ryan et al., 2020 n = 20	To evaluate effects of an ACT- informed group resilience training program for people with type 1 and 2 diabetes.	A single group intervention condition design with pre- and post-intervention assessments	ACT group intervention improved participants' resilience, psychological flexibility, affect, valued living, physical activity, and sedentary behaviors, and decreased depression and stress.
Somaini et al., 2023 n = 25	To examine the feasibility, acceptability, and preliminary effectiveness of an online ACT intervention for adults with Type 1 diabetes.	A single case experimental design	A web-based ACT intervention was an acceptable approach for adults with type 1 diabetes. Preliminary effectiveness was found for mood, anxiety, and physical activity. Web-based ACT also enhanced psychological flexibility and diabetes-specific well-being.

Authors Number of persons	Study aim	Method	Main conclusion
Zandkarimi & Ghahremany, 2022* n = 6	To investigate the effectiveness of ACT treatment on experiential avoidance, alexithymia, and emotion regulation in patients with type 1 diabetes.	A case study	ACT treatment was effective in reducing levels of avoidance, alexithymia, and emotion regulation; follow-up study showed that this treatment was also effective in lowering blood sugar

*Note: * The study was written in the authors' native language, and only the abstract of the study was available in English.*

1.9   Aims, research questions and hypotheses

ACT has been used widely to address health-related topics, but there is a dearth of studies on ACT-based interventions on adolescents with type 1 diabetes. The present study, one of the first in this area, consists of three original publications. Overall, the intent was to develop and examine an acceptance and commitment therapy intervention for the well-being of 12-16-year-old adolescents with type 1 diabetes. A five-session ACT intervention based on earlier research was created for the study.

The aim of **Study I** was to understand associations between psychological flexibility, a key concept of ACT, and health indicators among adolescents. The data was gathered from the pre-intervention measurements of the intervention study and included the intervention and control groups. The research questions were:

(1) Is glycemic control (HbA1c) associated with quality of life (QoL) and symptoms of depression and anxiety? (Figure 2)
(2) Is psychological flexibility associated with symptoms of depression and anxiety, quality of life, and glycemic control (Figure 3)
(3) Does diabetes-related psychological flexibility mediate the relationship between glycemic control and quality of life and depressive and anxiety symptoms? (Figure 4)
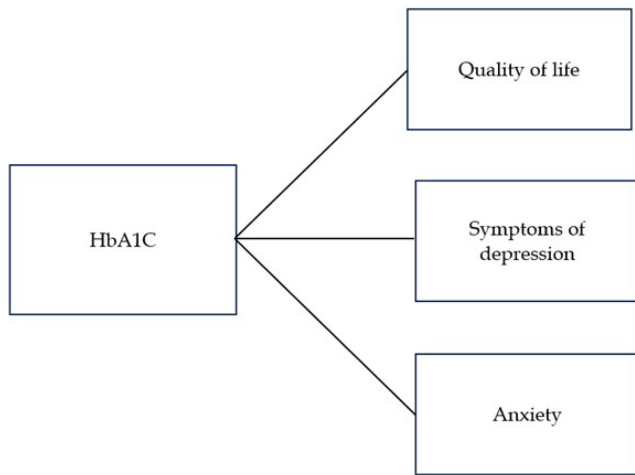
FIGURE 2   The hypothesized associations between glycemic control (HbA1c) and quality of life, symptoms of depression and anxiety.
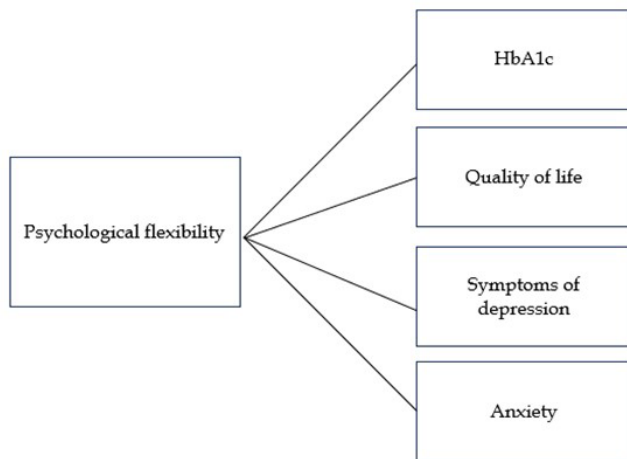
FIGURE 3   The hypothesized associations between psychological flexibility and glycemic control (HbA1c), quality of life, and symptoms of depression and anxiety.

a = the effect of independent variable on mediator
b = the effect of mediator on dependent variable
c′ = the direct effect of independent variable on dependent
variable
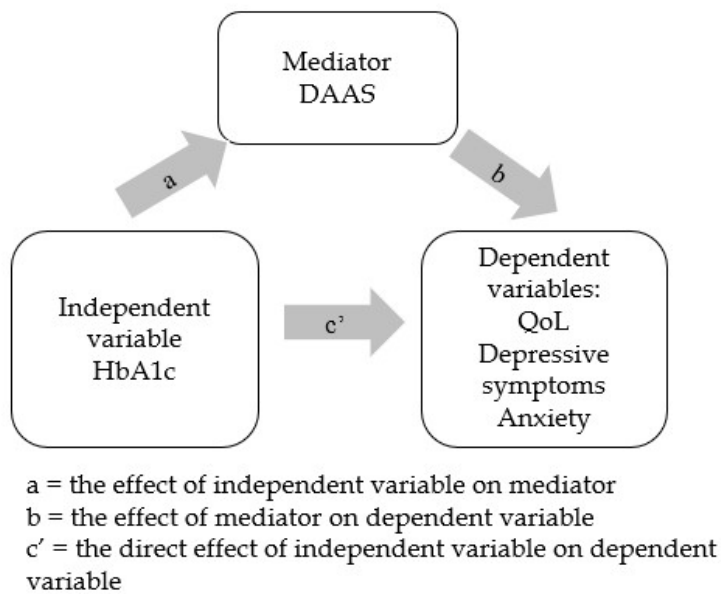
FIGURE 4   The hypothesized mediation model of diabetes-related psychological
flexibility (DAAS).

Based on earlier research, it was hypothesized that better glycemic control would be associated with better quality of life. It was also expected that high psychological flexibility would be associated with better glycemic control and quality of life. In addition, it was expected that psychological flexibility skills would mediate the relationship between chronic disease symptoms of depression and anxiety, and quality of life.

The purpose of **Study II** was to evaluate the effectiveness of an ACT-based group intervention for adolescents with type 1 diabetes who were struggling with diabetes management. Based on earlier research, it was hypothesized that the ACT intervention would have positive effects on adolescents with poorly managed type 1 diabetes. The research questions were:

(1) Does adding an ACT intervention to ordinary care (Treatment as usual, TAU) at a pediatric outpatient clinic have a positive impact on the adolescents' treatment of diabetes (glycemic control)?
(2) Does adding an ACT intervention to ordinary care promote psychological flexibility and mindfulness skills, increase their quality of life, and decrease depressive and anxiety symptoms compared to the control group (TAU)? (Figure 5)
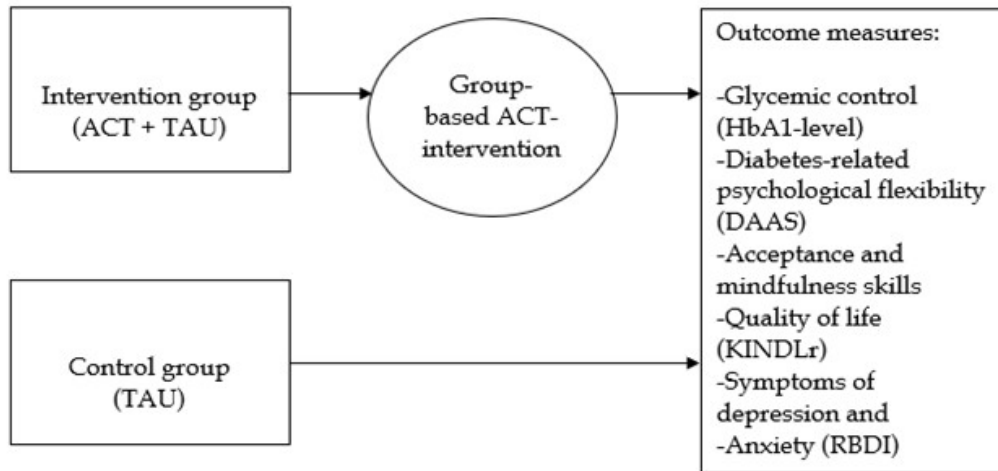
FIGURE 5   The research design in Study II.

Study III sought to deepen the knowledge about the effects of the intervention and to explore acceptance of the ACT intervention. Thematic analysis was used to analyze interviews with adolescents and their parents about the benefits and experiences of the intervention. Furthermore, interest lay in the examination of adolescents and their parents who experienced improvement due to the intervention, in comparison with those who showed no improvement. The improved and non-improved groups were defined according to changes in their HbA1c levels to gain knowledge as to who had benefitted most from the intervention. The research questions were:

(1) Were the adolescents satisfied with the intervention and adherent it?
(2) How the adolescents and their parents experienced the intervention?
(3) How those who showed improvement in their glycemic control differed from those who showed no improvement?

2 METHOD

2.1 Participants and procedure

Participants for the study were recruited from an outpatient pediatric diabetes clinic. The study was conducted at the Central Finland Health District (currently: Wellbeing Services County of Central Finland) in cooperation with the University of Jyväskylä. Recruitment for all three studies was conducted in phases from 2016–2019. Those 12–16-year-old adolescents within the diabetes clinic whose HbA1c was above the recommended level (7.5%) at the pediatric outpatient clinic were invited to participate. The exclusion criterion was current psychiatric or psychological treatment. Recruitment was conducted during visits to the pediatric clinic. Those willing to participate were divided randomly into intervention (ACT + TAU) and control (TAU) groups. The TAU group continued under treatment-as-usual conditions, which included visits to the pediatric clinic once every three months and meeting a doctor, a nurse, and other healthcare professionals at the clinic. The control group was offered the possibility to attend the intervention after the data had been gathered.

For **Study I**, the pre-intervention data was collected from both intervention and control groups. The data was gathered from the intervention group at the start of the intervention and from the control group at the same time by regular mail. There were 65 participants in **Study I**. Their mean age was 13.5 years (SD = 1.19) and there were more female (n = 41, 63%) than male (n = 24, 37%) participants. The mean HbA1c value at pre-intervention measurement was 9.34% (SD = 1.83) (recommended value < 7.5%). A total of 78 adolescents expressed interest in the study, but 13 adolescents cancelled their participation for unknown reasons before pre-intervention measurement (seven females, six males, mean HbA1c = 9.38%).

In **Study II** the data collected from the pre-and post-intervention measurements from the intervention group (n = 36) and the control group (n =

36) was used. The mean age of the participants in both groups was 13.4 years (ACT+TAU: mean = 13.4, SD = 1.13; TAU: mean = 13.4, SD = 1.22), and there were slightly more girls than boys in both groups (ACT+TAU; n = 24; 66.7%; TAU; n = 21; 58.3%). The dropouts and those who withdrew participation did not differ significantly from the group that was included in the analyses in background variables of age, gender, duration of illness, and glycemic control (HbA1c).

In **Study III** the data from those who completed the intervention (n = 28) was used. In this group, the mean age was 13.4 (SD = 1.12), mean level of HbA1c was 8.95% (SD = 1.55) at pre-intervention measurement, and there were more females (n = 20, 71%) than males (n = 8, 29%). To determine who gained most from the intervention, the group was divided into two subgroups based on improvement in the adolescents' HbA1c value. For the group that showed improvement (n = 15), the mean age was 13.8 (SD = 1.17) and the mean Hba1C level was 9.56% (SD = 1.53). Of this group, 80% were females (n = 12) and 20% were males (n = 3). For the group that showed no improvement (n = 13), the mean age was 12.9 (SD = 0.86) and their mean level of HbA1c was slightly lower (8.18%; SD = 1.23). Compared to the improved group, there were more males (n = 5; 38%) in this group. See Table 2 for background information. **Study III** used both qualitative and quantitative data. Quantitative data gave us answers concerning who benefitted more from this intervention, and this knowledge can be of use when developing interventions in the future. Qualitative data helped us to obtain more in-depth knowledge of the attendees' experiences of the intervention. Mixed-methods research strategies can be employed to learn to what degree and how and why an intervention works (Monaghan et al., 2011; Teddlie & Tashakkori, 2009).

TABLE 2   Background information of the participants in Studies 1, 2, and 3.

Study	n		Female		Male		Mean age (SD)		Mean HbA1c (SD)	
I	65		41 (63%)		24 (37%)		13.51 years (1.19)		9.34% (1.83)	
II	ACT	TAU	ACT	TAU	ACT	TAU	ACT	TAU	ACT	TAU
	36	36	24 (67%)	21 (58%)	12 (33%)	15 (43%)	13.44 (1.13)	13.36 (1.22)	8.94 (1.41)	9.11 (1.45)
III	28		20 (71%)		8 (29%)		13.41 (1.12)		8.95% (1.55)	
	Gr 1	Gr 2	Gr 1	Gr 2	Gr 1	Gr 2	Gr 1	Gr 2	Gr 1	Gr 2
	15	13	12 (80%)	8 (62%)	3 (20%)	5 (38%)	13.81 (1.17)	12.92 (.86)	9.56% (1.53)	8.18% (1.23)

Note: Study II: ACT = ACT intervention group. TAU = Treatment as usual group.
Study III: Gr 1 = Group that showed improvement in HbA1c-levels, Gr 2 = Group that stayed the same or showed no improvement in HbA1c-levels.

2.2 Measures

2.2.1 Glycemic control

To examine glycemic control, participants' HbA1c values were used. HbA1c is a proxy measure of a patient's average blood glucose level over the preceding three months (American Diabetes Association, 2021). HbA1c values are measured every three months at the pediatric outpatient clinic. For this study, the values were collected from medical records. The value preceding the start of the intervention (1–2 months before the intervention) was used for the pre-intervention measurement, and the equivalent value was used for the post-intervention measurement after three months (1–2 months following the end of the intervention).

2.2.2 Self-report measures

Psychological Flexibility and Acceptance and Mindfulness processes

Two psychological flexibility measures were used in all three studies. For diabetes-specific psychological flexibility, the Diabetes Acceptance and Action Scale for Children and Adolescents (DAAS; Greco & Hart, 2005) was used. It has been developed to measure the psychological flexibility of adolescents with type 1 diabetes, and it measures diabetes-related acceptance skills, experimental avoidance, and cognitive fusion. The questionnaire consists of 42 questions, and responses are given on a Likert scale from 0–4 (never true to always true). Higher scores indicate higher levels of psychological flexibility toward diabetes. It was translated from the original English version to Finnish with permission from the author of the measure, Laurie Greco.

For more general psychological flexibility, the Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011) was used. It was developed to measure the acceptance and mindfulness skills of children and adolescents. The questionnaire assesses the degree to which children and adolescents act with awareness, observe internal experiences, and accept internal experiences without judging them. The 10-question version of the questionnaire was used. Answers were given on a Likert scale from 0–4 (never true to always true), with higher scores indicating higher levels of mindfulness and acceptance.

Quality of life

To measure the quality of life of the adolescents, the Revised Children's Quality of Life Questionnaire (KINDL-R; Ravens-Sieberer & Bullinger, 1998) was used. The KINDL-R is a generic instrument for assessing health-related quality of life in children and adolescents aged 3–17 years. In this study, the generic youth-specific mode of the questionnaire was used, which consists of 24 questions (including subscales of physical and emotional well-being, self-esteem, family, social contacts, and school), and the diabetes-specific module, which consists of

17 questions. Also, the parents of the adolescents filled in the quality-of-life questionnaire concerning their child's quality of life (KINDL-r). The answers were given on a Likert scale ranging from 1–5. The six subscales were combined to form a total score of a maximum of 120, with higher scores indicating better quality of life. For the analysis, the scores were scaled from 0 to 100 points.

Symptoms of depression and anxiety

To measure symptoms of depression and anxiety, the Revised Beck Depression Inventory (RBDI) questionnaire was used. RBDI is a Finnish version of the Beck Depression Inventory (Beck & Beck, 1972) and has been modified to suit the adolescents. It consists of 13 questions measuring depressive symptoms and one question measuring self-reported symptoms of anxiety. The questionnaire can be used to estimate the severity of depressive symptoms and anxiety (Raitasalo, 2007). For each question there are five possible answers to choose from, and each item is scored from 0 to 3. The maximum score for measuring symptoms of depression is 39. Scores under 5 indicate no depressive symptoms; scores between 5 and 7 indicate mild depressive symptoms; scores between 8 and 15 indicate moderate depressive symptoms; and scores above 16 indicate severe depressive symptoms. The maximum score for the question measuring symptoms of anxiety is 3. The score indicates possible anxiety and its severity (1 = mild anxiety, 2 = moderate anxiety, and 3 = severe anxiety). See Table 3 for assessment measures.

2.2.3   Adherence and satisfaction with the treatment and the experiences

Adolescents' adherence to the intervention was measured by the drop-out rate and session attendance. Also, the adolescents and the parents were asked to evaluate their satisfaction with the intervention on a scale from 1 to 6 (1 = very satisfied, 2 = satisfied, 3 = somewhat satisfied, 4 = somewhat unsatisfied, 5 = unsatisfied, 6 = very unsatisfied). Regarding satisfaction with the length of the intervention, adolescents were asked to assess the length of the group intervention on a scale of 1 to 5 (1 = too short, 2 = slightly too short, 3 = appropriate, 4 = slightly too long, and 5 = too long).

Additionally, adolescents' satisfaction with, and experiences of, the intervention were investigated with semi-structured interviews conducted at the end of the last session intervention. Adolescents and their parents were interviewed individually. Each interview lasted from 15 to 30 minutes, and all interviews were conducted by psychology students trained for the purpose. The interviews consisted of questions related to satisfaction, perceived benefits of the intervention, acquired skills, length of the intervention, as well as whether they were willing to recommend the interventions to others.

Further, they were asked to reply either 'yes' or 'no' to whether they had benefitted from the intervention, both regarding the treatment of diabetes and more generally. An open-ended proposition ("Describe the perceived benefits and your experiences of the group") encouraged the adolescents to describe their

experiences of the intervention and its perceived benefits. Answers were examined using the thematic analysis. The adolescents were also asked to report the kinds of skills they had acquired during the intervention, indicating with 'yes' or 'no' one or more skills from ten alternatives. In terms of recommendation, adolescents were asked to reply with 'yes' or 'no' to whether they would be willing to recommend the group to other adolescents with type 1 diabetes.

As with the interviews for the adolescents, semi-structured interviews were conducted for the parents at the end of the intervention. Eight questions were related to satisfaction with the treatment, satisfaction with the length of the intervention, perceived benefits, as well as willingness to recommend the intervention.

Similarly, parents' general satisfaction was measured on a scale from 1 to 6. Parents were also asked to assess the length of the intervention on a scale from 1 to 5 and to reply 'yes' or 'no' to whether they perceived that their children had benefitted from the intervention, regarding both the management of diabetes and more generally. They were also asked to indicate with 'yes' or 'no' whether the intervention had any impact on the parents' own, or the family's, well-being. An open-ended question asked the parents to describe their experiences related to these topics, and their responses were explored using the thematic analysis. Parents were asked to reply 'yes' or 'no' to whether they would be willing to recommend the group to other adolescents.

TABLE 3   Assessment measures in Studies 1, 2, and 3.

	Study I	Study II	Study III	Time of the assessment
HbA1c	x	x	x	Study I: pre-intervention measurement Studies II and III: pre- and post-intervention measurement
DAAS Diabetes Acceptance and Action Scale for Children and Adolescents	x	x	x	Study I: pre-intervention measurement Study II: pre-and post-intervention measurements
CAMM the Child and Adolescent Mindfulness Measure	x	x	x	Study I: pre-intervention measurement Studies II and III: pre- and post-intervention measurements
KINDL-R the Revised Children's Quality of Life Questionnaire	x	x		Study I: pre-intervention measurement Study II: pre- and post-intervention measurements
RBDI Revised Beck Depression Inventory, Finnish version	x	x		Study I: pre-intervention measurement Study II: pre- and post-intervention measurements
Semi-structured interviews			x	Study III: post-intervention measurement

2.3 Intervention

An ACT-based intervention was created for the study. The intervention program was based on previous ACT interventions developed at the University of Jyväskylä that showed promising effects (e.g., Kyllönen et al., 2018). However, the themes and practices were modified to suit adolescents with type 1 diabetes.

Before the start of the actual intervention, the program was tested with a pilot group of five adolescents.

The ACT intervention encompassed five sessions, each lasting 1.5 hours, conducted biweekly, resulting in a total duration of 7.5 hours. Each group consisted of five to seven adolescents and convened at the hospital outpatient clinic. To enhance the learning experience, voluntary homework assignments were given at each session, and every participant received an exercise book. Moreover, the parents of the adolescent participants of the ACT+TAU intervention were invited to attend the beginning of the first and last sessions of the intervention, allowing them to familiarize themselves with the intervention procedures and participate in the interviews. The workbook is presented fully in the Appendix.

The main content of the ACT intervention is presented in Table 4. Each session involved, varyingly, group discussions, workbook-assisted exercises, experimental exercises, and metaphors. The main idea was that the adolescents would experience the activities during the sessions as versatile and fun. It was emphasized that the discussions were confidential, and everybody could decide freely how much they were willing to share about themselves.

The **first session** started with the pre-intervention measurements and the interviews, both for the adolescents and their parents. Parents also received information about the intervention. With the adolescents, the first session started with introductory games to get acquainted with the group. Then, the work continued with behavioral analysis, with each of the adolescents writing down those issues that they thought influenced their treatment of diabetes at the moment. Also discussed were previous solutions to improve diabetes management. Then, based on the analysis, individual goals for diabetes management were discussed. Values work was introduced with discussions, followed by a values exercise in which the adolescents wrote down what was important for them in life and if they lived according to their values. Also, an exercise with value cards was used to discuss the topic further: the adolescents were asked to choose a card that represents their own values. An experimental exercise, "Path of Well-being," was used to encourage reflecting on how to act at the moment to maintain well-being. In this exercise the adolescents were asked to choose a position on a line that represents their own situation, where one end depicts a scenario where they take many actions for their well-being, and the other end depicts a situation where they don't take actions regarding their well-being. The first session ended with the exercise "Leaves on a stream."; This exercise aims to target the ability to separate oneself from one's thoughts. Participants are asked to observe their thoughts and emotions as if they were written on leaves floating down a stream. Voluntary homework related to values and committed action was given: "Choose one thing based on your values that you would like to influence. Choose one step, one action, and practice it before the next meeting."

The **second session** started with catching up and then going through the homework. Values work continued with the exercise "Looking at your life from

the future," followed by the committed action exercises "Stepping out of the box" and "Breaking the routines." An additional purpose of these exercises was to recognize one's own ways of behaving and taking new perspectives. The "Achieving realistic goals" practice invited the adolescents to think of small steps and actions to achieve their goals related to diabetes management. In this exercise, adolescents wrote down their goals and step-goals as steps on a ladder, and everyone's goals were discussed in the group. The experimental exercise "I cannot do..." aimed to emphasize that we do not always need to believe our thoughts. In this exercise, the participants, for example, walked around the room and said in unison, "I cannot walk," or jumped around while saying "I cannot jump." The session ended with the practice "Leaves on a stream." Voluntary homework that encouraged continuing to act towards own values was given.

Session 3 started again with a review of the homework and discussing whether the participants had succeeded in acting toward their well-being values and goals. The issue of "obstacles" was discussed, and participants were encouraged to identify their obstacles and to think about why earlier solutions may not have worked. The theme "Taking distance to your thoughts and emotions" was discussed using an exercise in which the participants thought about some of their emotions or about diabetes. They were then asked to think what color, size, and shape that emotion would be and were encouraged to draw or color the thought. The exercise "Paying attention to your breathing" was conducted to practice mindfulness skills. In the end, the theme of acceptance was introduced using the metaphor "Tug of war with a monster" to demonstrate the struggle with internal experiences and the exhaustion that can result from the struggle. Voluntary homework was given to continue with value-based actions and to encourage the participants to do something mindfully, such as listening to a song or walking mindfully.

Session 4 started again with a review of the homework and discussing whether participants had succeeded with the homework. The theme "Self as context" was introduced and continued with the metaphors "House" and "Sky and I." This included discussions about conceptions of the self which may not be true; that is, we have thoughts and emotions, but we are not the thought or the emotion. The exercise "Don't think about (doughnuts)" demonstrated the idea that we cannot control or push away our thoughts or emotions, including those related to difficult emotions toward diabetes. Avoiding those thoughts or emotions usually makes the situation more difficult. The theme of Acceptance was started with the metaphor "Uninvited guest" to demonstrate those unwelcome, inconvenient, or unwanted "guests" that visit us in our daily lives. Earlier themes were worked further with the practice "Pop-up thoughts," in which adolescents wrote down on a piece of paper a thought that was bothering them. This piece of paper was given to the person sitting next to them, who started to read this troubling sentence aloud, providing the opportunity to react to it as a "pop-up thought."

Session 5 started in the same way as the earlier sessions. As this was the last session, there was general discussion about the themes processed during

earlier sessions. With the value cards, current thoughts about values were discussed, as well as adolescents' plans on how to act toward their values in future, in general, and as they related to diabetes. The practice "Path of well-being" was repeated, reflecting both the time before the intervention and the current situation. A mindfulness practice, "Paying attention to your breathing," then followed. The session ended with a practice in which all participants (including the group leaders) wrote down something pleasant about each member of the group on a piece of paper, and each participant received this paper as a memory of the group. The final session ended with interviews and post-intervention measurements.

TABLE 4   Summary of session content, exercises, and homework.

Session	Structured content	Related exercises	Homework
1	Behavioral analysis Values Committed action	What are the issues that have impacted my self-management? Previous solutions to improve my self-management Personal goals What I care about Value cards Path to well-being Lives on a stream	Value-based actions: To perform one action per day based on individual personal values
2	Values Committed action Thoughts and emotions Mindfulness	Looking at your life from the future Stepping out of the box Comfort zones Ladder -exercise: achieving realistic goals "I cannot do" exercise Leaves on a stream	Value-based actions: To perform one action per day based on individual personal values Step by step towards realistic goals: Make small steps towards your well-being
3	Thoughts and emotions Mindfulness Acceptance	Working with obstacles: why previous attempts have not been successful, identifying obstacles Distance between thoughts and feelings Paying attention to your breath Metaphor: Tug of war with a monster	Value-based action: To perform one action per day based on individual personal values Mindfulness: Listening mindfully to your favorite song or taking a walk mindfully
4	Self as a context Acceptance	Metaphors: House Sky and weather "Don't think..."(about doughnuts)	Value-based action: To perform one action per day based

Session	Structured content	Related exercises	Homework
		Strength cards Metaphor: "Uninvited guest" Pop-up thoughts The things and emotions I avoid most The stone on the beach	on individual personal values Making a plan: Who could help me achieve my personal goal?
5	Review of the themes	Value cards Path to well-being Goals to the future Pay attention to your breathing Closing exercise: giving positive feedback to each participant	

2.4 Statistical analysis

Data analyses were carried out using IBM SPSS Statistics version 26 and Mplus version 8.4. Table 5 describes the samples, variables, and analysis methods used in the three studies. Background variables (age, gender, HbA1c-level, illness duration) were reported in all studies.

In **Study I**, correlation coefficients were used to examine the associations between the variables. Correlations with $r \geq 0.50$ were regarded as strong and $r \geq 0.30$ as moderate (Kraemer et al., 2003). Also, to describe the investigated sample, the number of participants classified with mild, moderate, and severe symptoms of depression and anxiety was reported and QoL measures (mean, standard deviation, 95% CI) were compared to the available reference values of a German population of adolescents of the same age (n = 1895; Ravens-Sieberer et al., 2008) because a Finnish reference group was not available. Mediation analyses were conducted using bootstrapping (Preacher & Hayes, 2008) to determine whether diabetes-related psychological flexibility mediated the relationship between glycemic control (the independent variable) and QoL and depressive and anxiety symptoms (the dependent variables). Power analyses were conducted post-hoc using M+ software (version 8.4) and Monte Carlo simulations with 10,000 replications.

In **Study II**, the baseline differences between the groups (intervention group and control group) were explored with t-tests and chi-square tests for background variables (age, gender, duration of illness, and glycemic control). The group differences in change were analyzed using structural equation modelling (SEM) and latent change scores with the full information maximum likelihood (FIML) estimation method. All available information was used in the analyses, and missing data were assumed to be missing at random. Thus, all the randomized participants who completed the pre-intervention measurements

were included in the analyses. Effect sizes (ES) were reported using Cohen's d. The corrected between-group ES was calculated by dividing the change in the mean difference between the intervention and control groups by the pooled standard deviation of the pre-intervention measurement. To interpret Cohen's between- and within-group d, an ES of 0.20 was considered small, 0.50 moderate, and equal to or above 0.80 large (Cohen, 1988).

Mediations were calculated using Mplus software, with changes in diabetes-related psychological flexibility (DAAS) as the mediator of those outcome variables showing significant group differences in change (anxiety and HbA1c). The model fit was evaluated with several types of fit indexes, including the chi-square ($x2$), comparative fit index (CFI), and standard root mean square residual (SRMR). A non-significant $x2$ ($p > 0.05$), a CFI ≥ 0.95, and a SRMR < 0.08 were considered to indicate a good fit for the data. As recommended by Mackinnon (2008), the bias-corrected and accelerated bootstrap confidence intervals for the indirect effect were estimated using 1,000 bootstrap samples.

In **Study III**, the intervention group was divided into two subgroups according to the changes in the HbA1c levels: those who improved and those who showed no improvement. It was examined how these two groups differed in their evaluations (quantitative data) and themes (qualitative data). Thematic analysis using an inductive (data-driven) approach was conducted to explore the experiences of the adolescents and their parents about the intervention. The baseline differences and the differences in change scores between the subgroups for background variables, as well as for glycemic control and the self-report measures, were explored using the Mann-Whitney U test and chi-square test. A cross-tabulation analysis was used to explore whether the skills acquired differed and whether the experienced benefits of the parents and adolescents differed in the two subgroups.

TABLE 5   The samples, variables, and analysis methods in Studies I, II, and III.

Study	Sample	Variables	Analysis
Study I	Pre-intervention measurement data n = 65	HbA1c CAMM DAAS KINDL-r RBDI dep. RBDI anx.	Correlation coefficients (Associations between the variables) Mediational analysis
Study II	Pre-and post-intervention measurement data Intervention group n = 36 Control group n = 36	HbA1c CAMM DAAS KINDL-r RBDI dep. RBDI anx.	T-tests, chi square-test (baseline differences for background variables) Structural equation modeling (SEM) (the group differences in change) Full information maximum likelihood (FIML) estimation method (latent change scores) Effect sizes (within group differences and between group changes) Mediational analysis
Study III	Pre- and post-intervention measurements Those who completed intervention group n = 28	HbA1c CAMM DAAS	Mann-Whittney U test, Chi squared tests (baseline differences and the differences in change scores between the subgroups)

NOTE: HbA1c = glycemic control, CAMM = the Child and Adolescent Mindfulness Measure, DAAS = the Diabetes Acceptance and Action Scale for Children and Adolescents, KINDL-r = the Revised Children's Quality of Life Questionnaire, RBDI dep. = depressive symptoms in Revised Beck Depressive Inventory, RBDI anx. = anxiety symptoms in Revised Beck Depressive Inventory.

2.5   Ethical considerations

Ethics approval was obtained from the Central Finland Healthcare District's Ethics Committee (under registration number 7U/2015). Adolescents and their parents took part in the study on a voluntary basis and gave written informed consent to their participation in the study.

3 SUMMARY OF THE RESULTS

3.1 Study I

The aim of **Study I** was to determine whether the glycemic control (HbA1c-level) of the adolescents with type 1 diabetes was associated with quality of life (QoL), depression, and anxiety symptoms, and whether high psychological flexibility was associated with better glycemic control and better quality of life. Also, the goal was to find out whether diabetes-related psychological flexibility mediated the relationship between glycemic control and quality of life and depression and anxiety symptoms. The main focus was on the role of psychological flexibility in relation to glycemic control (HbA1c) and quality of life among adolescents with type I diabetes.

3.1.1 Symptoms of depression and anxiety and quality of life (QoL) in the sample

First, the levels of symptoms of depression and anxiety and QoL of the adolescents were investigated. At least mild depressive symptoms were reported by 20% of the participants and 39% reported at least mild anxiety symptoms. For QoL, the sample was compared to the German data (there was no Finnish data to compare for KINDL-r). Based on the 95% confidence intervals, the general level of QoL, and the levels of QoL related to self-esteem, friends, and school were higher in this group compared to the healthy reference group (Ravens-Sieberer et al., 2008). The other dimensions of QoL did not differ from the non-diabetic reference group.

3.1.2 Is glycemic control associated with depression symptoms, anxiety symptoms, and quality of life?

The results showed that glycemic control (HbA1c) correlated significantly with the level of symptoms of depression and anxiety; the higher the HbA1c (i.e., poorer control), the higher the level of symptoms. The correlations were moderate. Glycemic control was significantly associated with general QoL, QoL related to self-esteem, QoL at school, and with diabetes-related QoL. The correlations varied from small to moderate. Thus, the higher the HbA1c (i.e., poorer control), the lower the QoL. Figure 6 illustrates the correlations between glycemic control and general quality of life, and symptoms of depression and anxiety.
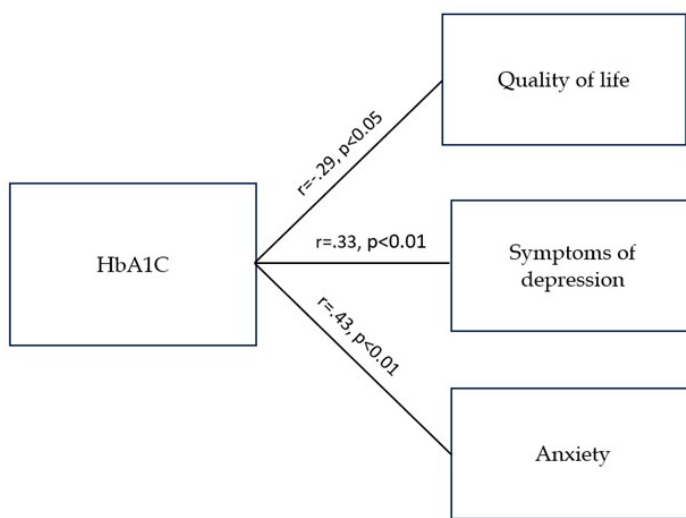
FIGURE 6   The correlations between glycemic control (HbA1c), quality of life, symptoms of depression and anxiety.

3.1.3 Is psychological flexibility associated with symptoms of depression and anxiety, quality of life, and glycemic control?

The results also showed correlations (moderate or strong) between psychological flexibility skills (both diabetes-related psychological flexibility measured by DAAS and mindfulness and acceptance skills measured by CAMM) and symptoms of depression and anxiety. Thus, a higher level of psychological flexibility was associated with lower levels of symptoms. As for quality of life, psychological flexibility skills (both diabetes-related and mindfulness and acceptance skills) were significantly correlated with all dimensions of QoL. In particular, diabetes-related flexibility correlated strongly with many dimensions of QoL. This suggests that the higher the psychological flexibility skills, the higher the quality of life (QoL). Psychological flexibility skills, both CAMM (-.31*)

and DAAS (-.39**), also correlated significantly and moderately with HbA1c-level. The higher the level of psychological flexibility, the better the glycemic control (lower HbA1c). Figures 7 and 8 illustrate the correlations between psychological flexibility (diabetes-related psychological flexibility measured by DAAS and acceptance and mindfulness skills measured by CAMM) and the other measures used in the study.
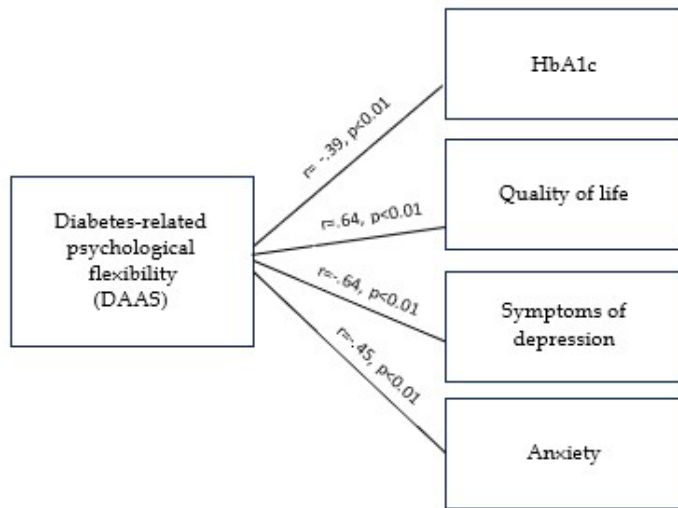
FIGURE 7   The correlations between diabetes-related psychological flexibility, glycemic control (HbA1c), quality of life and symptoms of depression and anxiety.
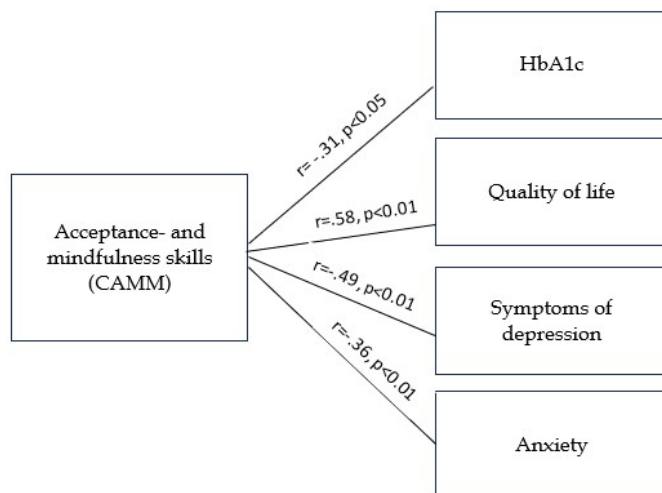
FIGURE 8   The correlations between acceptance and mindfulness skills (CAMM) and glycemic control (HbA1c), quality of life and symptoms of depression and anxiety.

3.1.4 Psychological flexibility as a mediator

Mediational analysis showed that diabetes-related psychological flexibility (DAAS) mediated the relationship between glycemic control and depressive symptoms, and the relationship between glycemic control and quality of life (see Figure 9). DAAS explained 69% of the total relationship between glycemic control and depressive symptoms and 86% of the relationship between glycemic control and general quality of life (QoL). Among the subscales of quality of life, the largest proportion explained by DAAS was found for the subscales of QoL related to family (85%) and self-esteem (78%).

a = the effect of independent variable on mediator
b = the effect of mediator on dependent variable
c' = the direct effect of independent variable on dependent variable
ab= indirect effect
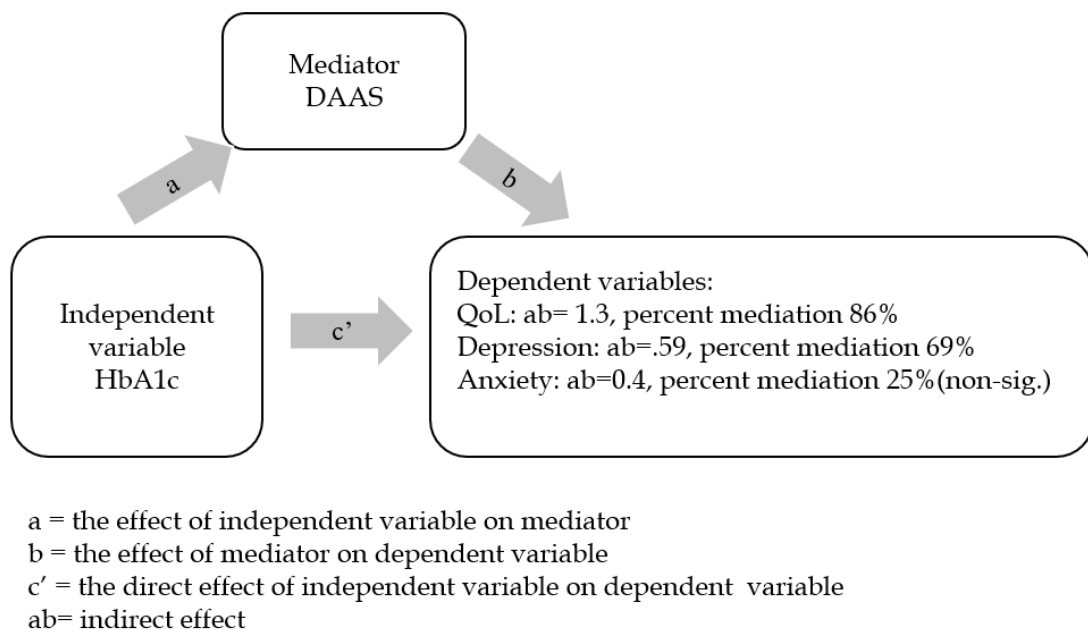
FIGURE 9   The mediation effects of diabetes-related psychological flexibility (DAAS): indirect effects (ab) and percent mediated by DAAS.

3.1.5 Key findings and Conclusions

The results of **Study I** indicated that psychological flexibility correlated significantly and moderately with the glycemic control of the adolescents. The higher the level of psychological flexibility skills of the adolescent, the better the glycemic control (lower HbA1c). A higher level of psychological flexibility was also associated with better quality of life and lower levels of depression and anxiety symptoms. Mediation analysis showed that diabetes-related psychological flexibility mediated the relationship between glycemic control and depression symptoms, as well as quality of life.

The observations in this study support the view that adolescents with type 1 diabetes would benefit from improving their psychological flexibility skills, as

psychological flexibility, especially as it relates to diabetes, was associated with many aspects of their well-being.

3.2 Study II

The main aim of **Study II** was to evaluate the effectiveness of an ACT-based group intervention for adolescents with type 1 diabetes who were struggling with diabetes management. More specifically, the aim was to evaluate whether adding an ACT intervention to ordinary care would have a positive impact on the adolescents' treatment of diabetes (glycemic control), psychological flexibility skills, and quality of life and depression and anxiety symptoms compared to adolescents undergoing treatment as usual (TAU).

3.2.1 Effectiveness of the intervention

The results showed a significant positive effect of the ACT intervention in comparison to treatment as usual on three of the key outcome measures: glycemic control (HbA1c), diabetes-related psychological flexibility (DAAS), and anxiety symptoms. The between-group ESs were moderate or close to moderate for glycemic control (d = 0.59) and symptoms of anxiety (d = 0.48), and small for diabetes-related psychological flexibility (d = 0.29). There was no significant effect in the pre- to post-intervention measurement change in symptoms of depression, acceptance, and mindfulness skills as measured by CAMM, and adolescent-reported quality of life, or parental evaluation of the adolescents' quality of life. Figure 10 shows the values of HbA1c, DAAS, and symptoms of anxiety for both groups at pre-and post- intervention measurement. Following the intervention, 29% of the adolescents in the ACT+TAU group had an HbA1c level of 7.5% or under, compared to 17% in the TAU group.
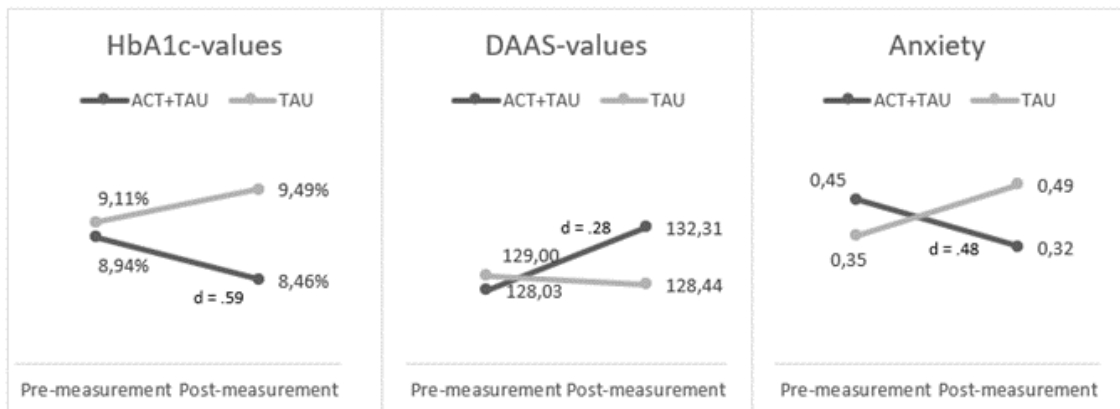
FIGURE 10   Mean values of glycemic control (HbA1c), diabetes-related psychological flexibility (DAAS), and anxiety.

3.2.2 Mediation analysis

Mediation analysis was used to determine whether changes in DAAS mediated changes in glycemic control and anxiety. The aim was to explore the role of DAAS in variables that were significantly impacted by the intervention. The mediations were not significant, suggesting that the changes observed in DAAS did not mediate the effect of the intervention on glycemic control and anxiety.

3.2.3 Key findings and conclusions

The results indicated that the intervention group (ACT+TAU) showed significantly larger changes in glycemic control, diabetes-related psychological flexibility (DAAS), and symptoms of anxiety compared to the control group receiving treatment as usual (TAU). Thus, adolescents in the intervention group improved more in glycemic control, their diabetes-related psychological flexibility improved, and anxiety decreased. The mediation analyses suggested that the change in DAAS was not a significant mediator of the changes in glycemic control.

Based on these findings, the ACT-based group intervention seems to be suitable for adolescents with type 1 diabetes who have difficulty controlling their chronic illness. Adding a psychological group-based intervention to standard (TAU) diabetes care for adolescents could increase treatment compliance.

3.3 Study III

The main aim of **Study III** was to explore the adolescents' and parents' experiences with the intervention, including acceptability, adherence, and satisfaction. The second aim was to investigate how adolescents whose glycemic control improved during the intervention differed from those who did not improve in regard to their background variables, acquired skills and experienced benefits and satisfaction with the groups. The improved and non-improved groups were defined according to the changes in their HbA1c levels.

3.3.1 Adolescents' adherence to the intervention

A vast majority, 90% (n = 28), of the adolescents who started in the intervention group (n = 31) completed it, and only three dropped out during the intervention. Most of the adolescents (89%, n = 25) participated in all sessions, the attendance rate being very good at 90%.

3.3.2 Satisfaction with the intervention (both adolescents and their parents)

The mean rating of the general satisfaction of the adolescents with the intervention was 1.79 (SD = 0.74) on a scale of 1 to 6, implying a high satisfaction

rate. Among the adolescents, 86% reported being either very satisfied (39%; n = 11) or satisfied (46%; n = 13), and 14% (n = 4) were somewhat satisfied. None of the adolescents were dissatisfied with the groups. Of the parents, 89% reported being either very satisfied (43%; n = 12) or satisfied (46%; n = 13) with the group; 7% (n = 2) were somewhat satisfied, while 4% (n = 1) were somewhat unsatisfied. Figure 3 shows the satisfaction rates for the adolescents and the parents.

A vast majority of the adolescents (86%; n = 24) were satisfied with the length of the intervention. Four adolescents evaluated the intervention as being a little too short. Of the parents, 61% (n = 17) were satisfied with the length of the intervention, while 43% (n = 12) evaluated the intervention as being too short or somewhat too short. Several parents reported that they had hoped for additional sessions, as changes in adolescent thinking and behavior might take more time. Also, some parents hoped that this kind of intervention would be possible in the future as part of the type 1 diabetes treatment.
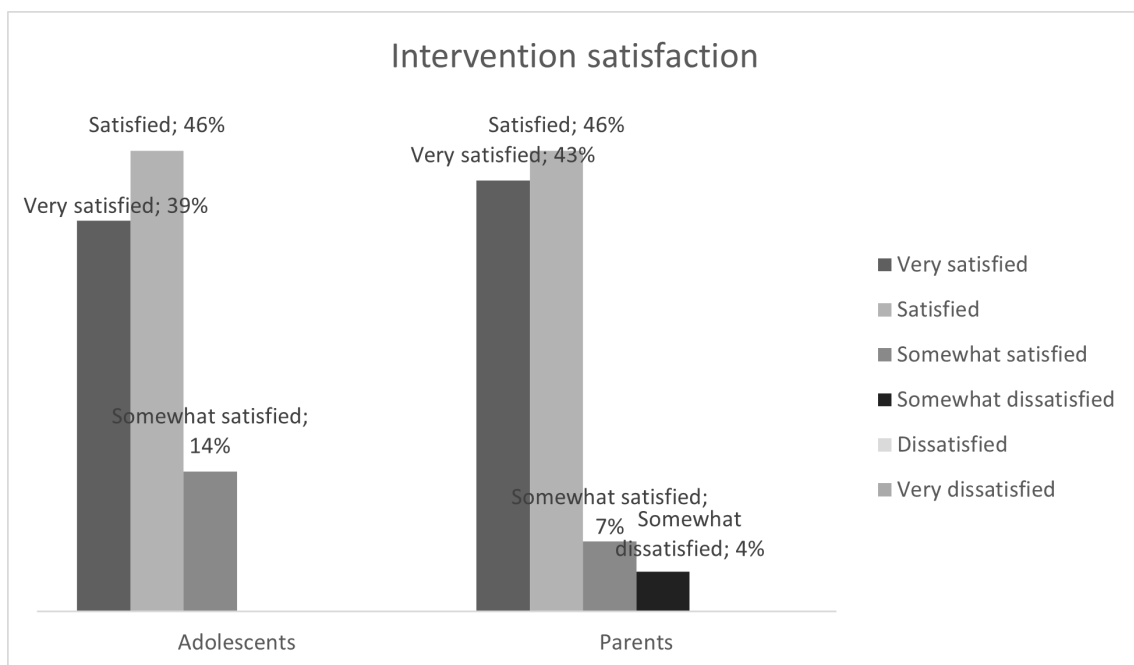
FIGURE 11   Intervention satisfaction.

3.3.3   Experienced benefits and acquired skills

In terms of benefits from the intervention, all adolescents reported that they gained benefits such as increased motivation for treatment and a better attitude towards diabetes, including positive effects on mood and changes in thinking. Regarding acquired skills, 71% (n = 20) reported (yes or no for each skill) having learned skills related to values and value-based actions (*Values clarification* and *Acting toward your values*). Skills related to the present moment (*Learning to become*

aware of your own thoughts and emotions) were mentioned by 64% (n = 18) of the participants.

Nearly 90% of the parents (89%; n = 25) perceived that the group had been beneficial to their adolescents' diabetes self-management, and a majority (61%; n = 17) reported that the intervention had also benefited their own well-being. They perceived that their concern and worrying about their adolescents decreased as their adolescents' motivation toward treatment improved. More than half (57%; n = 16) reported that the intervention had been beneficial to the well-being of the whole family, reporting that the atmosphere at home was better, as there were fewer arguments about diabetes between the adolescents and their parents or siblings.

All except one (n = 27; 97%) adolescent were willing to recommend the intervention to other adolescents with type 1 diabetes. The adolescent not willing to recommend the intervention belonged to the improved group and gave as a reason the fact that the skills taught by the intervention were already familiar to her. Except for one parent, all the others (97%; n = 27) were willing to recommend the group to others. One parent in the improved group was not willing to recommend the intervention as the parent perceived that it disturbed the adolescent's schoolwork.

3.3.4 Adolescents' and parents' experiences of the intervention (thematic analysis)

The thematic analysis, which addressed the adolescents' replies to the open-ended questions about their experiences and the perceived benefits of the intervention, yielded five themes. For the parents, thematic analysis yielded seven themes. Table 6 describes the themes and includes example quotes, as well as percentages indicating the frequency with which each theme was mentioned by the adolescents/parent. For the adolescents, the themes "Increased motivation and self-care," "Peer support and sharing," "Attitude towards diabetes" were mentioned most often. For the parents, the themes mentioned most often were "Changes in mood," "Attitude towards diabetes," and "Increased motivation and self-care."

TABLE 6　　Themes and example quotes of adolescents' and parents' experiences.

Adolescents		
Theme	Number of mentions (%)	Example of the theme
Increased motivation and self-care	15 (54%)	"'I have started to measure my blood sugar levels more often and started taking more responsibility for my diabetes."

Peer support and sharing	12 (43%)	"You could see that others were going through the same stuff with diabetes; you are not alone with your problems."
Attitude towards diabetes	11 (39%)	"I have a more positive attitude towards diabetes now. I have noticed that I'm not the only one having difficulties with it."
Changes in mood	5 (18%)	"My mood has improved, as I have been able to talk about diabetes with people who understand what it is like."
Changes in thinking	3 (10%)	"I received new ways of thinking, as we have thought about our own values and whether we act towards our values."

Parents

Theme Number of mentions (%)		Example of the theme
Changes in mood	14 (48%)	"She/he has been more balanced and calmer."
Attitude toward diabetes	12 (41%)	"It has been easier to talk about diabetes and the child has been more open to discuss self-management."
Increased motivation and self-care	11 (38%)	"'The child has checked her blood sugar more frequently. She is more aware of it and does it regularly."
Peer support and sharing	9 (31%)	"The child has experienced that it's good that you don't need to explain yourself, as everybody (in the group) knows what it's like to have diabetes. This has helped with the emotions."
Benefits for the parent's well-being	8 (29%)	"When the child feels better, you feel better as well."
Atmosphere at home and decreased conflict	7 (24%)	"It is easier at home; we don't fight that much anymore."
Independence, increased sense of responsibility	6 (21%)	"She/he has started to think about diabetes and the future. She/he talks more about it and is getting more independent and takes more responsibility for the treatment."
Changes in thinking	4 (14%)	"This has changed the child's thinking about diabetes and other stuff as well. His/her thinking isn't so 'black and white' anymore."

3.3.5 Differences between the improved and not-improved adolescents

Of the results concerning the differences between those adolescents whose HbA1c levels improved between the pre- and post- intervention measurements, a statistically significant difference was observed in the adolescents' age (p = .04) and in the level of HbA1c at pre-intervention measurement (p = .02): in the group that improved in glycemic control, the adolescents were older (mean 13.8 years, SD = 1.17), and their HbA1c was higher (mean 9.6, SD = 1.53) compared to the group that showed no improvement (Age: mean 12.9 years, SD = 0.86; HbA1c: mean 8.18, SD = 1.23). The groups did not differ in the duration of diabetes or gender. Also, the two groups did not differ significantly in acceptance and mindfulness skills (CAMM) or in diabetes-related psychological flexibility (DAAS) at the pre-intervention measurement. However, a statistically significant difference was found in the change of diabetes-related psychological flexibility, which increased more in the group that improved compared to the group that showed no improvement. However, the two groups did not differ in change in acceptance and mindfulness skills (CAMM).

When investigating satisfaction with the intervention, there were no statistically significant differences between the two groups in the adolescents' or their parents' evaluations. The satisfaction rate for adolescents who improved in glycemic control was M = 2.00 (SD = 0.73), while the rate for their parents was M = 1.88 (SD = 0.22). For adolescents who showed no improvement, M = 1.54 (SD = 0.52), while for their parents, M = 1.54 (SD = 0.52). There were no differences in most of the variables between the two subgroups regarding the perceived benefits of the intervention. For the adolescents, no significant differences between the groups were detected in the reported themes. Parents in the non-improved group reported more often that they had benefitted from the intervention compared to parents in the improved group. The two subgroups did not differ in the skills adolescents reported having learned.

3.3.6 Key findings and conclusions

Based on these results, the ACT intervention was well suited to this group of participants. All the adolescents and 97% of the parents reported being satisfied with the intervention. Based on the thematic analysis, themes that arose from the experiences of adolescents included, for example, increased motivation for the treatment of diabetes and a better attitude toward diabetes. Among the parents, themes such as positive changes in mood, better attitude toward diabetes, and increased motivation for treatment emerged. In terms of group differences, those who improved with regard to glycemic control were older, their HbA1c was higher at the start, and they reported greater changes in diabetes-related psychological flexibility.

The ACT-based group intervention was well accepted and complemented well the usual treatment. Based on the qualitative findings, both adolescents and parents perceived several important benefits from the intervention. Thus, this

intervention is recommended in addition to treatment-as-usual, especially for adolescents who do not meet their glycemic targets.

4 DISCUSSION

This study had three main objectives. The first objective was to study the associations between psychological flexibility and glycemic control and the adolescents' well-being, laying ground for an ACT-intervention. The second, and the most important objective was to evaluate the use of an Acceptance and Commitment Therapy (ACT)-based group intervention as an adjunct to the treatment for adolescents with type 1 diabetes whose HbA1c levels were not within the recommendation range. Thirdly, the aim was to study the acceptability of, and experiences with, the intervention, and to investigate how adolescents whose glycemic control improved during the intervention differed from those who showed no improvement.

Compared to the treatment as usual (TAU) group, the intervention group (ACT+TAU), which included an additional group-based Acceptance and Commitment Therapy (ACT) program, showed significantly larger changes in glycemic control, diabetes-related psychological flexibility, and symptoms of anxiety at post- intervention measurement. Following the intervention, 29% of the adolescents in the ACT+TAU group had an HbA1c level of 7.5% or under, compared to 17% in the TAU group. All the adolescents reported being satisfied with the additional group intervention, and 97% were willing to recommend it to others. Based on the thematic analysis, themes that arose from the experiences of the adolescents included increased motivation for treatment of diabetes and a better attitude toward the illness. Among the parents, themes such as positive changes in mood, better attitude toward diabetes, and increased motivation for treatment emerged. In terms of group differences, those who improved regarding glycemic control were older and their HbA1c was higher at the start, and they reported greater changes in diabetes-related psychological flexibility as measured by DAAS. Also, the results indicated that, among adolescents with elevated HbA1c levels, a higher level of psychological flexibility was associated with better glycemic control, better quality of life, and lower levels of depression and anxiety symptoms. In addition, mediation analysis indicated that diabetes-related psychological flexibility mediated the relationship between glycemic

control and depression symptoms, as well as quality of life. However, the role of diabetes-related psychological flexibility as a mediator for changes in HbA1c levels was not confirmed during the intervention.

4.1 Discussion of the main findings of the three studies

4.1.1 Study I

The level of quality of life and symptoms of depression and anxiety among adolescents with elevated glycemic levels

When compared to Finnish adolescents in general (Strandholm & Ranta, 2013; Wargh et al., 2015), the prevalence of moderate or severe depression and anxiety symptoms was not higher among the group of adolescents with type 1 diabetes investigated in this study. It is important to note, however, that the exclusion criterion in the study was psychiatric diagnosis, so those adolescents with severe psychological symptoms were not included in the study, and this may have affected the results regarding the prevalence of depression and anxiety symptoms.

The finding of the quality of life of adolescents with type 1 diabetes, in general, was similar to that of healthy adolescents. This is consistent with earlier studies, which reported that adolescents with type 1 diabetes, even though burdened by their illness, reported high satisfaction with life and evaluated their quality of life (QoL) similarly to their peers (Murillo et al., 2017; Niuewesteeg et al., 2012). Based on the 95% confidence intervals, the general level of quality of life, and the level of quality of life related to self-esteem, friends, and school were higher in the diabetes group than in a healthy reference group (Ravens-Sieberer et al., 2008). There is some research to support these findings. Stahl and colleagues (2012) reported improved self-esteem and quality of life related to school in adolescents with type 1 diabetes compared to a healthy control group. Findings of the meta-analysis conducted by Reynolds and Helgeson in 2011 revealed no significant differences between the groups in terms of self-esteem or peer difficulties. However, the results of this current study, comparing this study group to a group of German adolescents (a study by Ravens-Sieberer et al., 2008) should be interpreted cautiously, as these samples represent two different countries and cultures. Also, it should be noted that while there is ample literature on the well-being and quality of life of adolescents with type 1 diabetes, many studies are small, or involve selected populations, or the studies are becoming outdated, thus limiting the ability to draw definitive conclusions.

Associations between glycemic control and quality of life, and symptoms of depression and anxiety

The results showed that the HbA1c-levels correlated significantly with the level of symptoms of anxiety and depression and quality of life. The higher the HbA1c (i.e., poorer control), the lower the quality of life and higher level of symptoms of anxiety and depression. These results indicate the importance of level of glycemic control on the psychological well-being of the adolescents. Earlier results in line with this finding show that good glycemic control is associated with better quality of life (for example, Hilliard et al., 2013; Bratke et al., 2022). As reported above, it was found that poorer control of diabetes (e.g., higher HbA1c) was associated with lower school-related quality of life. Adolescents spend long days at school and need to take care of their diabetes during lunch, breaks, gym, and other activities. This tends to be difficult for many adolescents, who do not want to look different from their peers. Avoiding diabetes treatment in social situations may worsen self-management of the illness. Also, poorer glycemic control was associated with a higher level of anxiety and depressive symptoms. This is consistent with previous studies (Buchberger et al., 2016; Hassan et al., 2006; Kongkaew et al., 2014). The co-occurrence of depression and anxiety with diabetes can worsen quality of life (Goldney et al., 2004) and potentially predispose the individual to problems in adulthood (Insabella et al., 2007).

Associations between psychological flexibility and glycemic control, quality of life, and depressive and anxiety symptoms

The results indicated that a higher level of psychological flexibility was associated with better glycemic control and better quality of life, and lower levels of depression and anxiety symptom. Psychological flexibility was measured with two self-report measures: diabetes-related psychological flexibility was measured with the DAAS questionnaire (Greco & Hart, 2005), and acceptance and mindfulness skills were measured with the CAMM questionnaire (Greco et al., 2011). There were significant correlations between both flexibility measures and glycemic control, quality of life, and depression and anxiety symptoms. Correlations were moderate or strong. In particular, diabetes-related psychological flexibility correlated strongly with general quality of life and quality of life related to emotional well-being, self-esteem, school, and diabetes.

These findings suggest the importance of psychological flexibility skills in the well-being of adolescents in general populations (for example, Halliburton & Cooper, 2015; Swain et al., 2015). Puolakanaho et al. (2023a) found in their recent study an association between psychological flexibility and psychological symptoms of Finnish adolescents. Also, Lappalainen et al. (2021) found a link between psychological flexibility and depression in an intervention study of 15-year-old adolescents in Finland. Earlier research supports this finding; psychological flexibility has been associated with the quality of life of adolescents

(Di Battista et al., 2009) and levels of depression (Plumb et al., 2004) and anxiety (Karekla et al., 2004) symptoms.

As for diabetes, Hadlandsmyth et al. (2013) suggested that the problems in the treatment of diabetes in adolescence could be related to psychological inflexibility. Attempts to avoid facing problems through behavioral or emotional avoidance could be a way for adolescents with diabetes to handle difficulties (Jaser & White, 2011). Avoidance of diabetes treatment, such as delaying checking blood glucose, or taking insulin, may offer momentary relief from the negative emotions associated with diabetes. However, the avoidance pattern may lead to the attitude that diabetes is unmanageable, as well as feelings of guilt. Diabetes-related distress may interfere with further self-management and weaken glycemic control (Iturralde et al., 2017). Nicholas et al. (2022) found that greater psychological flexibility was associated with lower HbA1c levels and less diabetes distress in their study involving adults with type 1 diabetes.

In this study, the original 42-item scale of the DAAS-questionnaire was used. As such, the questionnaire was lengthy to complete. A revised and validated version, DAAS-R (Gillanders & Barker, 2019), has been developed and this version could be more useful when working with young people.

Psychological flexibility as a mediator

The mediation analysis showed that diabetes-related psychological flexibility mediated the relationship between glycemic control and depression symptoms and the relationship between glycemic control and quality of life. In other words, the way the child handled emotional reactions related to diabetes, and whether the child used avoidance strategies or not when dealing with diabetes (as measured by DAAS), mediated a great amount of the association between glycemic control and quality of life. A high proportion of the total relationship between glycemic control and quality of life relating to family and self-esteem was explained by diabetes-related psychological flexibility. However, level of anxiety was not mediated by psychological flexibility, which was not expected. The mediation was marginally not significant (CI -0.001; 0.11); however, it is possible that, with a larger sample, the mediation would have been significant. Overall, these observations highlight the role of diabetes-related psychological flexibility in type 1 diabetes among adolescents. The mediating role of psychological flexibility for well-being in adolescents has been demonstrated only in few earlier studies. For example, Puolakanaho et al. (2023b) found, in their study with adolescents, that those with negative affectivity showed an increase in symptoms of stress and depression mediated by lower psychological flexibility whereas adolescents with effortful control and extraversion showed a decrease in symptoms, mediated by higher psychological flexibility. However, there are no studies specifically related to adolescents with type 1 diabetes regarding the mediational role of psychological flexibility.

4.1.2 Study II

Effectiveness of the ACT-based group intervention

The results of **Study II** show that, when compared to the treatment as usual group (TAU), the intervention group (ACT+TAU) showed greater improvement in glycemic control (HbA1c level), diabetes-related psychological flexibility, and symptoms of anxiety. There was no significant effect in the pre- to post-intervention measurement change in symptoms of depression, acceptance, mindfulness skills, adolescent-reported quality of life, or parental evaluation of the adolescents' quality of life.

While the intervention increased diabetes-related psychological flexibility (DAAS), equivalent changes were not observed in acceptance and mindfulness skills (CAMM). There could be several reasons for this. The ACT group intervention focused heavily on the psychological flexibility skills associated with diabetes management. Furthermore, disease-specific measures such as DAAS might better capture changes in adolescents' attitudes toward their disease. It is also possible that problem-specific instruments are more responsive than generic measures (e.g., Wiebe et al., 2003). Thus, in accordance with Berlin et al. (2020), it was found that DAAS was a useful measure in the context of type 1 diabetes treatment.

The results also indicated that, while intervention had a positive impact on anxiety symptoms, it had little effect on depression symptoms or quality of life. Anxiety and distress specifically related to diabetes are common (Anderson, 2011) and represent barriers to optimal diabetes management (Weissberg-Benchell & Antisdel-Lomaglio, 2011); therefore, attending the group intervention may have eased this distress. In fact, the treatment as usual group showed a tendency toward an increase in anxiety, while the ACT+TAU group reported slightly lower levels of anxiety after the intervention. However, there was no intervention effect on depression symptoms. It is important to note that the exclusion criterion for the study was frequent psychological or psychiatric treatment, so that a parallel psychological treatment would not interfere with the results of the current intervention. Thus, as adolescents with severe psychological symptoms were excluded from the study, the level of depression and anxiety symptoms was already low at the beginning of the intervention. It is also noteworthy that anxiety symptoms were measured with only one question ("Do you feel anxious or distressed?"); therefore, the results should be interpreted with caution. Furthermore, the item did not distinguish between general anxiety and diabetes-specific anxiety.

This study is one of the first to investigate the use of an ACT-based group intervention in a group of adolescents with type I diabetes. Thus, there is not much research to reflect these findings, specifically concerning ACT and adolescents with type 1 diabetes targeting glycemic control. However, these results are in line with a proposal by Hadlandsmyth et al. (2013), who suggest in their treatment conceptualization that an ACT intervention would be a useful tool to increase psychological flexibility in adolescents with type 1 diabetes.

Adolescents with diabetes might fuse with aversive internal experiences and engage in avoidant behaviors that result in poor diabetes management. Also, the findings in **Study I** concerning the relationships between psychological flexibility, glycemic control and well-being justify the use of ACT-based intervention, as the main aim of ACT is to increase psychological flexibility.

Concerning adolescents with type 1 diabetes, there are studies to be found targeting psychological outcomes. Moghanloo et al. (2015) found that an ACT approach was effective in reducing depression and feelings of guilt, as well as increasing well-being, in 7–15-year-old diabetic children with type 1 diabetes. Similarly, Moazzezi et al. (2015) found ACT effective in reducing perceived stress and in increasing special health self-efficacy in 7–15-year-old children with type 1 diabetes. However, these studies do not report effects on glycemic control.

Related to the use of general psychological interventions for improving the management of diabetes, there is proof that psychological interventions can lead to improvements in glycemic control in adolescents (Aljawarneh et al., 2020). For example, Rechenberg and Koerner (2021) found that cognitive behavioral therapy (CBT) techniques could improve both psychosocial and physiological outcomes (HbA1c) in adolescents with type 1 diabetes. In accordance with findings in the current study, there is support for the advantages of using a modern type of CBT, acceptance and commitment therapy (ACT), for adolescent well-being (e.g., Halliburton & Cooper, 2015; Swain et al., 2015). A meta-analysis by Fang and Ding (2020) found ACT to be effective in children and adolescents for anxiety, depression, and other mental and behavioral disorders.

Mediation analysis

Mediation analysis was used to determine whether changes in diabetes-related psychological flexibility (DAAS) would mediate the changes in glycemic control and anxiety. This was hypothesized based on earlier findings in **Study I**, which found associations between glycemic control and depression symptoms and between glycemic control and quality of life at the pre-intervention measurement level. To the best of our knowledge, there is no prior research specifically addressing the mediating effect of the Diabetes Acceptance and Action Scale (DAAS). However, in a study by Gregg et al. (2007) involving adults with type 2 diabetes, psychological flexibility was found to mediate the effect of an ACT intervention on HbA1c levels. In their study, diabetes-related psychological flexibility was measured using the Acceptance and Action Diabetes Questionnaire (AADQ). Furthermore, psychological flexibility has been identified as a mediator of favorable outcomes. For instance, Lin et al. (2018) demonstrated that psychological flexibility mediated various outcomes, including pain interference, anxiety, depression, pain intensity, and mental and physical health, in an online ACT intervention for chronic pain.

In the current study, the mediations were not significant, however, suggesting that the changes observed in diabetes-related psychological flexibility did not mediate the effect of the intervention on glycemic control and anxiety. There could be several reasons for this. First, the impact of the intervention on

diabetes-related psychological flexibility was small. The intervention was very brief and included only five sessions. A longer intervention might have been necessary to produce larger changes in flexibility. Second, the statistical power to detect the effect might have been too small due to the relatively small sample size (n = 60). Also, it is possible that process variables other than DAAS could explain the treatment outcome, alternatively, DAAS is not sensitive enough to detect changes among the adolescent population. Thus, further studies are needed to clarify the role of psychological flexibility in interventions for type 1 diabetes.

4.1.3 Study III

Study III used both qualitative and quantitative data. Quantitative data provided answers concerning who benefitted more from this intervention, and this knowledge can be of use when developing interventions in future. Qualitative data was used to obtain more in-depth knowledge concerning the attendees' and their parents' experiences of the intervention. Mixed-methods research strategies can be employed to learn both to what degree and how and why intervention works (Monaghan et al., 2011; Teddlie & Tashakkori, 2009).

Adherence and satisfaction with the intervention

The high attendance number of the intervention indicates that the intervention was suitable and well-accepted among this group of adolescents and that the participants were motivated to attend the intervention. Also, satisfaction with the group intervention was high among both the adolescents and their parents. More than 85% of both adolescents and their parents reported being satisfied or very satisfied with the intervention, and all except one adolescent and one parent were willing to recommend the intervention to others. None of the adolescents reported being dissatisfied with the groups. Findings from other studies are in line with these results. For example, a positive psychology intervention study among adolescents with type 1 diabetes (Jaser et al., 2014) reported a rate of 90% for attendance and high satisfaction with the intervention. These positive responses to the intervention are important findings, as adolescent adherence to treatment can be challenging, making it even more important to identify engaging interventions (Cunningham et al., 2021).

Forty-three percent of the surveyed parents expressed a desire for an extended duration of the intervention, indicating a preference for additional sessions. Furthermore, a few parents articulated their hope for the continuity of such interventions in the future. This suggests that parenting children with type 1 diabetes is a stress-inducing and challenging experience which parents need assistance with. Parents may have noted the benefits of the intervention for their children and appreciated the fact that they were not the only ones to support their children. Adolescence is an intrinsically demanding phase, and a chronic condition can further increase stress and worry for both adolescents and their parents. Extending the duration of the intervention would offer an opportunity to engage parents, potentially enhancing adolescent well-being. Research

indicates that involving parents can yield significant benefits for teenagers (Sheng et al., 2018).

All except one adolescent were willing to recommend the intervention to other adolescents with type 1 diabetes. The adolescent not willing to recommend the intervention belonged to the improved group and gave as her reason the fact that the skills taught were already familiar to her. Also, all except one parent were willing to recommend the group to others. One parent who was part of the improved adolescent group was not willing to recommend the group as the parent perceived that it disturbed the adolescent's schoolwork. The timetable was taken into consideration when the groups were planned: The groups were organized in the afternoon after the school day, however, this could still be too early for some families. When planning groups, it is important to consider whether the timing of the groups is suitable for both the participants and their families.

Acquired skills and experienced benefits

Regarding acquired skills, a majority (71%) of the adolescents reported having learned skills related to values and value-based actions. According to Tunç et al. (2023), valued living is a critical mechanism of change to target within the ACT therapeutic model. This essential content of ACT may fit well with adolescents' exploratory nature and their increasing capability for abstract thinking (Fang & Ding, 2020; Hadlandsmyth et al., 2013). Skills related to the present moment were mentioned by 64% of the participants. Also, this domain of psychological flexibility is known to be essential for well-being (Keng et al., 2011).

In terms of benefits from the intervention, all adolescents reported that they had perceived benefits, such as increased motivation for treatment and a better attitude toward diabetes, including positive effects on mood and changes in thinking. Nearly 90% of the parents perceived that the group had been beneficial to their adolescents' diabetes self-management. This finding is encouraging because the main goal of the intervention was to assist adolescents in managing their diabetes. The overall benefits of improved self-management are significant, both presently and in the future. Also, a majority (61%) of the parents reported that the intervention had been beneficial for their own well-being. This is an interesting result, as the intervention targeted the adolescents, not their parents. The parents perceived that, as their adolescents' motivation toward treatment improved, parents' own concern and worrying about them decreased. Also, more than half (57%) of the parents reported that the intervention had been beneficial to the well-being of the whole family, reporting that the atmosphere at home was better, as there were fewer arguments about diabetes between the adolescents and their parents or siblings. These findings are notable because it is known that parental distress among teens with type 1 diabetes has potential health consequences both for the parent and the child (Hessler, 2016). According to Bassi et al. (2021), parents experience relatively high levels of anxiety, depression, and stress related to managing their child's diabetes, and parental stress predicts a worsening in the control of HbA1c levels. In addition, poorer metabolic control

can occur in the presence of higher levels of diabetes-specific family conflicts (Sander et al., 2010; Scholes et al., 2013). While parental involvement is important, treating diabetes in adolescents may also create conflicts between the parent and the adolescent (Tuohy et al., 2019). Based on parental interviews at the beginning of the study, conflicts and disagreements were reported by several parents. Earlier studies have found that parents have difficulty allowing adolescents to be independent in managing their diabetes (Wennick et al., 2009).

Adolescents' and parents' experiences of the intervention

Thematic analysis was conducted to obtain qualitative knowledge about participants' perceptions of, and experiences with, the intervention. The acquired advantages from the intervention reported most often by the adolescents were increased motivation for treatment of diabetes, acquired peer support and sharing, and a better attitude toward diabetes. Motivation for treatment was one of the main targets of the intervention, and this shows that an ACT approach was well suited for this purpose. In addition, many adolescents reported attitudinal changes toward diabetes. The adolescents also appreciated peer support and sharing with others, which are known to be important in all chronic illnesses (Ahola Kohut et al., 2014). Peer support is recommended for individuals with type 1 diabetes to reduce the distress of living with the condition, to facilitate independence in self-management, and to improve outcomes (Young-Hyman et al., 2016). For example, DeJonckheere et al. (2021) found a similar theme in their study, where the adolescents and their parents valued the experience of being around others with type 1 diabetes and their families.

Regarding the experiences of the parents, many reported that they had observed positive changes in mood, increased motivation for treatment, and a better attitude toward diabetes in their children. For instance, changes in mood were reported by nearly half of the parents. A vast majority (89%) of the parents reported that the intervention had been beneficial to their children's diabetes self-management. About one in five parents (21%) observed an increased sense of responsibility and independence in their children. These findings are encouraging, as adolescents need to develop autonomy in disease management and health-related tasks gradually, with complete autonomy often arriving in late adolescence (Beacham & Deatrick, 2013; Tuohy et al., 2019).

Differences between those who improved and those who showed no improvement

Finally, the differences between those adolescents whose glycemic control levels improved and those who did not show improvement, in terms of their perceptions of the experiences with the intervention, were investigated. Similar advantages were perceived in both groups. Interestingly, those whose blood glucose levels remained at the same level or lower also gave positive feedback concerning the intervention and reported having experienced benefits from attending the groups. Thus, based on the feedback from adolescents, the

investigated intervention model has benefits beyond beneficial changes in improvement in glycemic control.

Additionally, differences between the groups were found in the adolescents' age and HbA1c level at the beginning of the intervention. This indicates that the older adolescents and those whose glycemic control was weaker benefitted more from the intervention provided. This finding is in accordance with the results of earlier studies. For instance, Katz et al. (2014) found that adolescents with suboptimal glycemic control benefitted more from the interventions than those who achieved the treatment targets. Also, Shapiro et al. (2021) proposed that at-risk adolescents with lower levels of modifiable skills would benefit more from psychosocial skill-building interventions. In accordance with this, it was reported in an ACT study aiming to reduce stress symptoms that adolescents experiencing more stress at baseline gained the most from the intervention (Puolakanaho et al., 2019). Based on this result, it can be assumed, that those adolescents who had problems in self-management (as indicated by poorer glycemic control in pre-intervention measurement) had more room for improvement and benefitted more from the intervention.

Furthermore, diabetes-related psychological flexibility increased more in the group that improved in glycemic control (HbA1c). This suggests that improvement in glycemic control was related to increased diabetes-specific psychological flexibility skills, including attitude to diabetes and diabetes-related acceptance. However, the role of diabetes-related psychological flexibility is still unclear. **Study I** found that higher diabetes-related psychological flexibility was related to better glycemic control. However, the change during the intervention observed in diabetes-related psychological flexibility did not mediate the effect of the intervention on HbA1c in **Study II**. Conversely, in the current study, the change in non-specific acceptance and mindfulness skills as measured by CAMM did not differ significantly between the benefitted and non-benefitted groups. Thus, further studies are needed to explore the processes responsible for the changes in glycemic control.

4.2 Ethical considerations

Given that the target group of this study comprised chronically ill young people, who are in a sensitive stage of life, it is paramount to consider ethical aspects. These concerns were carefully addressed during the planning of the study and the implementation of the intervention. However, it is worth noting that although both adolescents and parents provided written consent for participation, it is possible that the decision regarding the adolescent's attendance at the intervention was made by the parents. It was made clear that participation was voluntary, and if participants wished to withdraw from the study, it would be possible without affecting their treatment at the diabetes outpatient clinic.

Additionally, it should be highlighted that the intervention proved to be beneficial, suggesting the importance of being able to offer such interventions in the future and potentially providing training to other professionals for wider implementation. At the hospital where this data was collected and the intervention was administered, ACT groups have been continued as a voluntary part of treatment for adolescents seeking assistance with motivation. It is important to note, from an ethical standpoint, that the exclusion criteria for this study included psychiatric diagnoses or ongoing treatment, to prevent interference with the study results. This criterion resulted in the exclusion of individuals with the most significant problems.

4.3 Limitations and strengths

A significant limitation of the study is its small number of participants. For this reason, generalizing these results must be done cautiously. The small sample was due to the fact that the participants were recruited from a single, relatively small hospital with a limited number of adolescents with type 1 diabetes. Also, the pandemic interrupted data collection. Furthermore, the findings represent those adolescents and their parents who were motivated to participate in an intervention study. Also, the exclusion criteria for the study included adolescents who, according to the patient files, reported ongoing psychological/psychiatric treatment so that a parallel psychological treatment would not interfere with the results of the current intervention. However, this criterion limits the interpretation of these results, as some of those adolescents who were struggling with diabetes were not invited to participate.

Although few participants dropped out during the intervention (10% over three years), a limitation is that the reasons for dropping out or canceling participation before the study began are unknown. Understanding these reasons could provide valuable insights into participants who are difficult to engage. The background variables of those who dropped out or withdrew before the intervention did not differ significantly from the group included in the analyses. It can be assumed that some of those who dropped out had a problematic relationship with diabetes, and attending the intervention might have been too burdensome for them. More attention should be paid to these questions in future studies.

In addition, caution must be exercised when generalizing the qualitative results from **Study III** to people not represented in the sample, for qualitative methods are by their nature more subjective and can thus lead to opportunities for erroneous and biased conclusions (Chapman et al., 2015). It was not possible to interview the participants in the control group at the end of the study, so the possibility that the positive feedback obtained from the adolescents and their parents was due to treatment as usual cannot be ruled out. Also, it must be kept in mind that self-report measures such as CAMM, DAAS, KINDL-r, and RBDI reflect responses to specific questions in these measures. Furthermore, as this

study was targeted to the adolescents, background information about the parents is lacking, and this may be considered a limitation. As for the measurement of glycemic control, the recommended HbA1c level that was valid at the start of the study, and which was used throughout data collection, changed during the study.

Furthermore, it is not possible to separate the impact of peer support in the results concerning the effects of the intervention. Also, for those in the intervention group, the knowledge of being in a treatment condition and being studied could have had an impact on the results. In addition, the TAU group included several treatment elements, making it difficult to describe the type of intervention that the control group received. Furthermore, the lack of a follow-up study can be considered a significant limitation. Finally, it must be noted that HbA1c values were collected from medical records and the time between the two measure-points was short (3–5 months).

Despite the limitations, the study has several strengths. The intervention used has a strong theoretical background, with ample previous research available on the use of ACT-based methods. The measures employed were carefully chosen to collect information on both psychological flexibility and overall well-being, including a physiological measure (HbA1c). The statistical analyses were meticulously selected. Additionally, the combination of qualitative methods with quantitative ones provides a broad perspective, allowing for the inclusion of the opinions and thoughts of both adolescents and their parents.

4.4 Clinical implications

Study I highlights the importance of psychological flexibility for the well-being and diabetes management of adolescents with type 1 diabetes. There is previous research on the importance of psychological flexibility for the general well-being of adults, children, and adolescents, but the association between psychological flexibility, especially diabetes-related psychological flexibility and glycemic control, has been scarcely examined.

Based on the results of Studies II and III, an ACT-based intervention is both suitable and acceptable for adolescents with type 1 diabetes. Both quantitative and qualitative results support its use for this group of adolescents. It is notable, that none of the adolescents were dissatisfied with the groups. Based on these results, this type of intervention can be recommended for use in addition to treatment as usual. In addition to the benefits to the adolescent, the current intervention might also help to ease parental distress and diabetes-related family conflicts, even though the intervention targets adolescents.

In this study, the diabetes-related psychological flexibility measure, DAAS, appeared to be a useful instrument for obtaining knowledge of adolescents' thoughts and emotional reactions toward diabetes. Further, the DAAS correlated strongly with quality of life at pre-intervention measurement (**Study I**). Based on the current findings, the DAAS questionnaire, or an equivalent measure, such as the shortened version, DAAS-r), could be recommended for use in routine

clinical settings to obtain information concerning an adolescent's attitudes and behavioral patterns toward their diabetes. Further, diabetes-related psychological flexibility was associated with glycemic control, suggesting that diabetes-related psychological flexibility (e.g., how the child handles their feelings related to diabetes and whether the child uses avoidance strategies when dealing with their diabetes) could be a potential target for intervention among adolescents with poor glycemic control.

The intervention created for this study could also be adapted for use with other clinical adolescent groups, such as obesity or pain-related problems at pediatric outpatient clinics. From a clinical perspective, ACT groups and the techniques used here are highly suitable for adolescents with somatic health problems.

4.5 Future research

The findings from this study suggest that ACT holds promise as an effective strategy to address experiential avoidance and cognitive fusion among adolescents who struggle with their diabetes management. By focusing on these processes and guiding adolescents in identifying and adhering to their values, improvements in diabetes management may be facilitated. Future research endeavors should explore the specific elements or processes that contribute to positive outcomes in glycemic control as well as individual difference in treatment effects. Long-term monitoring is essential to ascertain whether the observed positive changes are sustained over several years and potentially carried into adulthood. The time between pre- and post-intervention measurement in this study was short, so results from longer follow-ups are needed. Also, more information would be needed to determine the optimal length or amount of the treatment. The intervention investigated in the current study included only 7.5 hours of active treatment; more intensive and longer treatment might increase the impact of the intervention. However, a longer intervention could increase drop-out rates and decrease compliance and satisfaction with the treatment.

In addition, other, more flexible delivery methods than traditional group-based interventions would be needed to ensure better access to evidence-based treatments. This group was a face-to-face group with meetings taking place at the hospital clinic. As web-based ACT programs have shown to be both feasible and efficient, it would be interesting to deliver and test the current intervention as a web-based program or through the use of a videoconference application. Earlier studies have shown that web-based interventions are beneficial for supporting adolescent well-being and career preparation, reducing stress, and increasing psychological flexibility (Kiuru et al., 2021; Lappalainen et al., 2021; Puolakanaho et al., 2019).

Furthermore, as mentioned above, the mediating role of psychological flexibility in this study was somewhat ambiguous. Therefore, larger samples of

adolescents with type 1 diabetes, as well as longer studies, would be needed to verify the role of psychological flexibility as a mediator. Also, as the results of this study support the use of an ACT intervention with adolescents with type 1 diabetes, future research could address the ways in which training in this method could be implemented for other professionals.

4.6 Conclusions

Given the widespread prevalence and the inherent challenges associated with managing pediatric diabetes, the development of interventions that can potentially foster improved diabetes management in adolescents is of outmost importance. This study is the first to examine the impact of an ACT-based intervention on glycemic control. The results suggest that the acceptance and commitment-based approach and intervention model hold promise for adolescents dealing with type 1 diabetes and experiencing difficulties in diabetes management. Therefore, it is suggested that incorporating an ACT-based intervention into treatment as usual in diabetes care for adolescents in routine clinical settings could increase treatment compliance and deliver additional benefits for both adolescents and their families. The current study suggests that this type of intervention is beneficial not only for the self-management of diabetes in adolescents, but also for the general well-being of adolescents and their parents. However, further studies are needed to confirm the currents findings and conclusions.

YHTEENVETO (SUMMARY)

Nuoret ja tyypin 1 diabetes: Ryhmämuotoisen hyväksymis- ja omistautumisterapeuttisen intervention vaikuttavuus ja hyväksyttävyys

Tyypin 1 diabeteksen esiintyvyys on Suomessa maailman korkeinta (Norris et al., 2020). Diabeteksen hyvän hoitotasapainon saavuttaminen vaatii paljon omahoitoa ja motivaatiota, ja etenkin nuoruusiässä omahoito heikkenee usein. Arvioidaan, että vain noin 17 prosenttia nuorista pääsee hoitotasapainotavoitteeseen (American Diabetes Association, 2021). Fysiologisten tekijöiden lisäksi psykologiset tekijät vaikuttavat nuoruusiässä hoidon heikkenemiseen ja näin ollen myös psykologisia menetelmiä diabeteksen hoidossa on tärkeä kehittää ja tutkia. Tämän tutkimuksen tavoitteena oli tutkia ryhmämuotoisen hyväksymis- ja omistautumisterapiaan (HOT, ACT; Acceptance and Commitment Therapy, ACT, Hayes et al., 2012) pohjaavan intervention vaikutuksia ja kokemuksia nuorilla, jotka sairastavat tyypin 1 diabetesta ja joiden pitkäaikaissokeritaso on yli suositusarvojen (tutkimuksen aikainen suositustaso HbA1c $\leq$ 7.5 %). Tutkimus tarkasteli myös psykologisen joustavuuden yhteyksiä nuorten pitkäaikaishoitotasoon ja psyykkiseen hyvinvointiin.

Hyväksymis- ja omistautumisterapia on kolmannen aallon käyttäytymisterapiamenetelmiin kuuluva hoitomenetelmä, joka pyrkii auttamaan ihmistä elämään täysipainoisemmin omien arvojensa mukaista elämää ja opettamaan yksilöä kokemaan ajatuksensa ja tunteensa, ei muuttamaan tai poistamaan niitä. Tavoitteena on psykologisen joustavuuden lisääntyminen ja tätä kautta parempi psyykkinen hyvinvointi (Keng et al., 2011).

Tutkimusta varten laadittiin hyväksymis- ja omistautumisterapiaan pohjautuva viiden kerran ryhmäinterventio, joka toteutettiin Keski-Suomen keskussairaalan lastentautien poliklinikalla (nykyinen Keski-Suomen hyvinvointialue). Tutkimukseen osallistujat rekrytoitiin lasten diabetespoliklinikan asiakkaista, osallistujat olivat 12–16-vuotiaita nuoria. Osallistuminen tutkimukseen oli vapaaehtoista. Osallistujat satunnaistettiin interventio- (HOT + TAU) ja tavanomaisen hoidon (TAU, treatment-as-usual) ryhmiin. TAU-ryhmän osallistujille tarjottiin mahdollisuutta osallistua interventioon tutkimuksen jälkeen. Ennen varsinaisen tutkimusdatan keruuta ryhmän toimivuutta testattiin pilottiryhmällä. Tutkimusdata kerättiin vuosin 2016 ja 2019 välillä.

Nuorilta kerättiin tietoa heidän pitkäaikaissokeritasostaan (HbA1c-arvo) potilasrekisteristä. Tämän lisäksi kerättiin lomaketietoa liittyen psykologiseen joustavuuteen, elämänlaatuun sekä masennus- ja ahdistusoireisiin. Nuorten vanhemmilta kerättiin tietoa liittyen nuorten elämänlaatuun. Tutkimustietoa kerättiin sekä ennen intervention alkua että sen jälkeen sekä interventio- että tavanomaisen hoidon ryhmiltä. Lisäksi interventioryhmän nuoret ja heidän vanhempansa haastateltiin ennen ryhmiä ja sen jälkeen.

Ryhmäinterventio toteutettiin hyväksyntä- ja arvopohjaisin menetelmin ja periaattein. Harjoitukset suunniteltiin niin, että ne soveltuivat käytettäväksi

nuorten kanssa. Ohjelmassa oli vaihdellen keskustelua, tehtäviä, toiminnallisia harjoituksia, läsnäoloharjoituksia ja metaforia. Ryhmää varten laadittiin työkirja, johon koottiin ryhmäkerroilla käytetyt harjoitukset ja tehtävät sekä kotitehtävät. Ryhmässä käytetty työkirja on väitöskirjan liitteenä englanninkielisenä. Nuoret saivat lisäksi vapaaehtoisia kotitehtäviä, joiden tavoitteena oli syventää ryhmässä opittuja taitoja. Kotitehtävänä oli esimerkiksi lisätä omien arvojen mukaista käyttäytymistä arjessa. Lastentautien psykologi ohjasi ryhmät apunaan psykologian opiskelijoita. Hyväksymis- ja omistautumisterapian erityisosaaja ja kliinisen psykoterapian professori osallistui ryhmäsisältöjen suunnitteluun. Ryhmäkertoja oli yhteensä viisi ja ne olivat kestoltaan 1,5 tuntia (5 x 1,5 h). Ryhmätapaamiset toteutettiin kahden viikon välein Keski-Suomen keskussairaalassa. Vanhempia pyydettiin osallistumaan ensimmäisen ryhmän alkuun ja viimeisen ryhmän loppuun.

Intervention vaikutuksia tutkittiin pitkäaikaissokeriarvon lisäksi psykologisilla itsearviointimittareilla. Psykologista joustavuutta tarkasteltiin kahden lomakkeen avulla: CAMM-mittarilla (Child and Adolescent Mindfulness Measure) arvioitiin nuorten hyväksyntä- ja tietoisuustaitoja, ja DAAS-mittarilla (Diabetes Acceptance and Action Scale for Children and Adolescents) diabetekseen liittyvää psykologista joustavuutta. Elämänlaatua tarkasteltiin KINDL-r mittarilla (Revised Children's Quality of Life Questionnaire) ja masennus – ja ahdistusoireistoa RBDI-mittarilla (Revised Beck Depression Inventory). Lisäksi interventioryhmään osallistuneilta nuorilta ja heidän vanhemmiltaan kerättiin tietoa puolistrukturoitujen haastatteluiden avulla.

Osatutkimus I keskittyi tarkastelemaan psykologisen joustavuuden yhteyttä pitkäaikaissokeritasoon (HbA1c), elämänlaatuun ja mielialaan ennen interventiota. Tietoa kerättiin sekä interventio- että tavanomaisen hoidon ryhmiltä (n = 65). Tulokset osoittivat, että nuorten psykologisen joustavuuden taidot (sekä hyväksyntä- ja tietoisuustaidot että diabetekseen liittyvä psykologinen joustavuus) korreloivat pitkäaikaissokeritason, elämänlaadun ja masennus- ja ahdistuneisuusoireiden tason kanssa. Mitä paremmat psykologisen joustavuuden taidot nuorella oli, sitä parempi pitkäaikaissokeritaso, parempi elämänlaatu, ja sitä vähemmän masennus- ja ahdistusoireita. Mediaatioanalyysi osoitti, että diabetekseen liittyvä psykologinen joustavuus välitti suhdetta pitkäaikaissokeritasapainon ja masennusoireiden sekä elämänlaadun välillä.

Osatutkimus II selvitti ryhmäintervention vaikutuksia nuorten pitkäaikaissokeritasoon, diabetekseen liittyvään psykologiseen joustavuuteen, hyväksyntä- ja tietoisuustaitoihin, masennus- ja ahdistusoireiluun sekä elämänlaatuun. Tulokset osoittivat, että tavanomaiseen hoitoon (n = 36) verrattuna interventioryhmässä (n = 36) havaittiin merkitsevästi suurempia muutoksia pitkäaikaissokeritasapainossa, diabetekseen liittyvässä psykologisessa joustavuudessa ja ahdistuneisuusoireissa. Masennusoireissa, hyväksyntä- ja tietoisuustaidoissa ja elämänlaadussa ei havaittu muutoksia.

Osatutkimuksessa III tutkittiin intervention hyväksyttävyyttä ja hyötyjä kvantitatiivisin ja kvalitatiivisin menetelmin niiltä nuorilta, jotka suorittivat intervention loppuun (n = 28) ja heidän vanhemmiltaan. 86 % nuorista ja 89 %

vanhemmista ilmoittivat olevansa joko hyvin tyytyväisiä tai tyytyväisiä ryhmään. 97 % nuorista ja 97 % vanhemmista olivat valmiita suosittelemaan ryhmiä muille nuorille, joilla on diabetes. Laadullisia haastatteluaineistoja tarkasteltiin teemahaastattelun keinoin. Nuorten kokemuksista nousivat esille mm. lisääntynyt hoitomotivaatio ja myönteisempi suhtautuminen diabetekseen. Vanhemmat toivat esiin mm. myönteiset muutokset nuoren mielialassa, myönteisemmän suhtautumisen diabetekseen ja lisääntyneen hoitomotivaation. Vanhemmat toivat esille myös hyötyjä liittyen omaan jaksamiseensa ja perheen ilmapiiriin. Osatutkimuksessa III tarkasteltiin myös sitä, kuinka ne nuoret, joiden hoitotasapaino parani enemmän intervention aikana (n = 15) erosivat nuorista, joiden hoitotasapaino pysyi samana tai heikkeni (n = 13). Tulokset osoittivat, että ne nuoret, jotka olivat iältään vanhempia, joiden pitkäaikaissokeri oli korkeampi alussa, ja joilla oli suurempia myönteisiä muutoksia diabetekseen liittyvässä psykologisessa joustavuudessa, hyötyivät ryhmästä eniten. Laadullisia eroja näiden kahden ryhmän välillä ei ollut. Lisäksi nuoret molemmissa ryhmissä olivat tyytyväisiä ryhmiin ja halukkaita suosittelemaan niitä muilla nuorille.

Kokonaisuudessaan tutkimukset tulokset nostavat esille psykologisen joustavuuden merkityksen tyypin 1 diabetesta sairastavilla nuorilla. Paremmat psykologisen joustavuuden taidot olivat yhteydessä parempaan pitkäaikaissokeritasoon sekä parempaan elämänlaatuun ja vähäisempään masennus- ja ahdistusoireiluun. Intervention vaikutuksia tutkittaessa sekä määrälliset että laadulliset tulokset osoittivat, että HOT-menetelmiin pohjaava ryhmäinterventio, jonka tavoitteena on psykologisen joustavuuden lisääminen, soveltui hyvin käytettäväksi tyypin 1 diabetesta sairastavien nuorten kanssa ja sillä oli suotuisia vaikutuksia nuorten diabeteksen hoitoon ja hyvinvointiin. Interventioryhmään osallistuneiden nuorten pitkäaikaissokeritaso parani enemmän verrattuna tavanomaisen hoidon ryhmään. Nuoret sekä heidän vanhempansa olivat tyytyväisiä ryhmiin, halusivat suositella niitä muille ja toivat esille useita hyötyjä liittyen nuorten hyvinvointiin ja hoitomotivaation paranemiseen. Näiden havaintojen perusteella voidaan todeta, että psykologisen HOT-ryhmäintervention lisääminen tavanomaiseen diabeteksen hoitoon voisi parantaa nuorten hoitomyönteisyyttä.

Tämä tutkimus on tärkeä lisä nykyiseen sekä diabetekseen liittyvää hyvinvointia koskevaan tutkimukseen ja että hyväksymis- ja omistautumisterapiaa koskevaan tutkimukseen. Tämä tutkimus on yksi ensimmäisistä, joka kartoittaa HOT-menetelmien käyttöä tyypin 1 diabetesta sairastavien nuorten kohdalla.

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WORKBOOK FOR TEENS
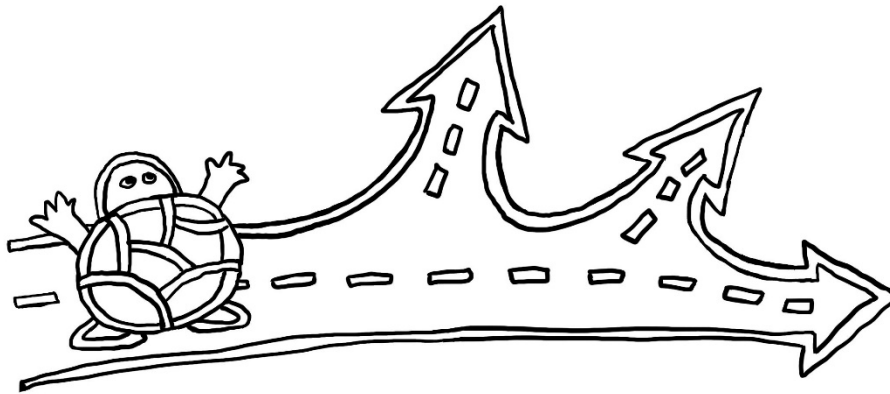
By Iina Alho and Raimo Lappalainen,
2019

GROUP SESSION 1

YOUR CURRENT SITUATION

To bring about change, it is important to find out about your current situation. What factors are affecting your situation/problem?

EXERCISE

Write in the circles the things that influence the problem you have chosen in your case:
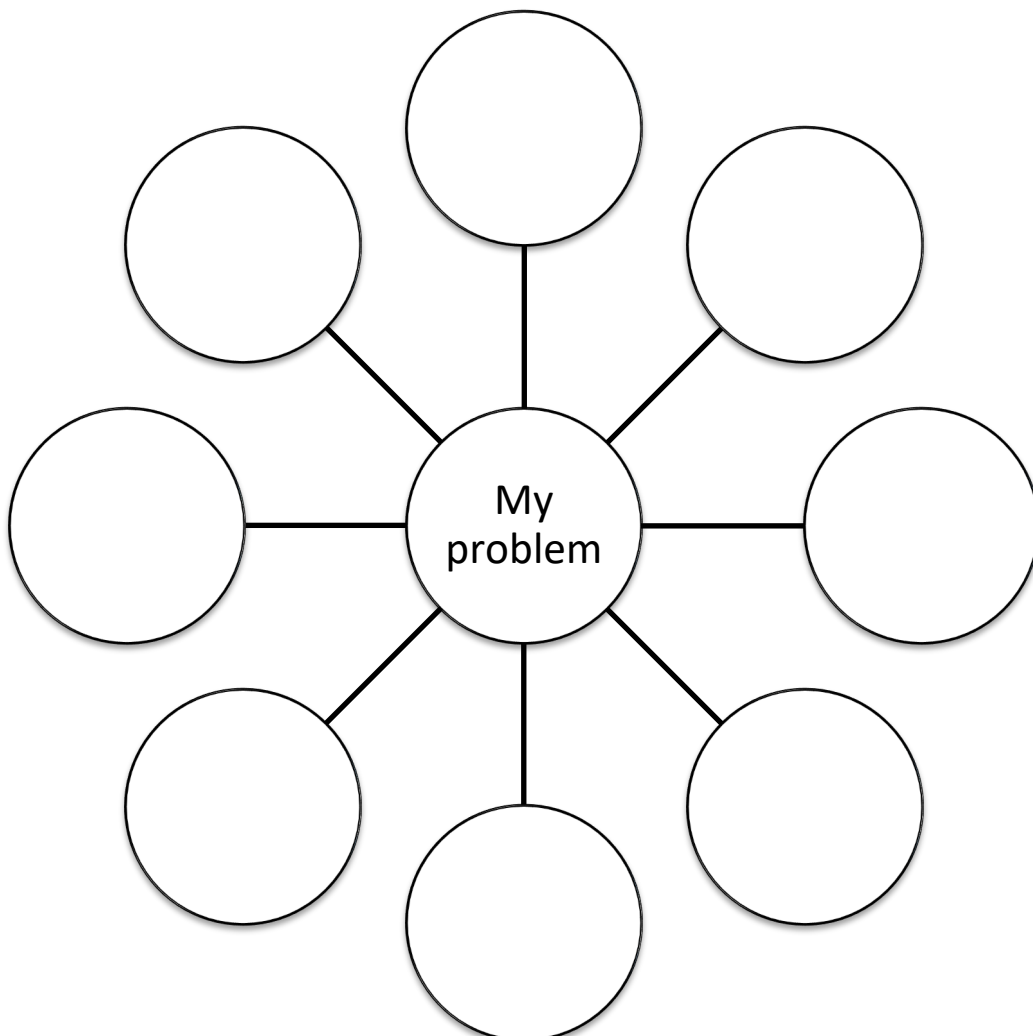
EXERCISE:

Next, think about what you have already tried in order to solve the problem. What have the parents, the staff at the pediatric clinic, or someone else tried? What about you? How have these attempts worked? Write down the things in the speech bubbles.

VALUE WORK - WHAT MATTERS TO YOU

EXERCISE:

You can reflect on the things that are important to you with the exercise below. Imagine a situation in which you have complete freedom to determine what is most important to you. In each of the circles, write down one thing that reflects a value or thing that is important to you.

Things I
care about

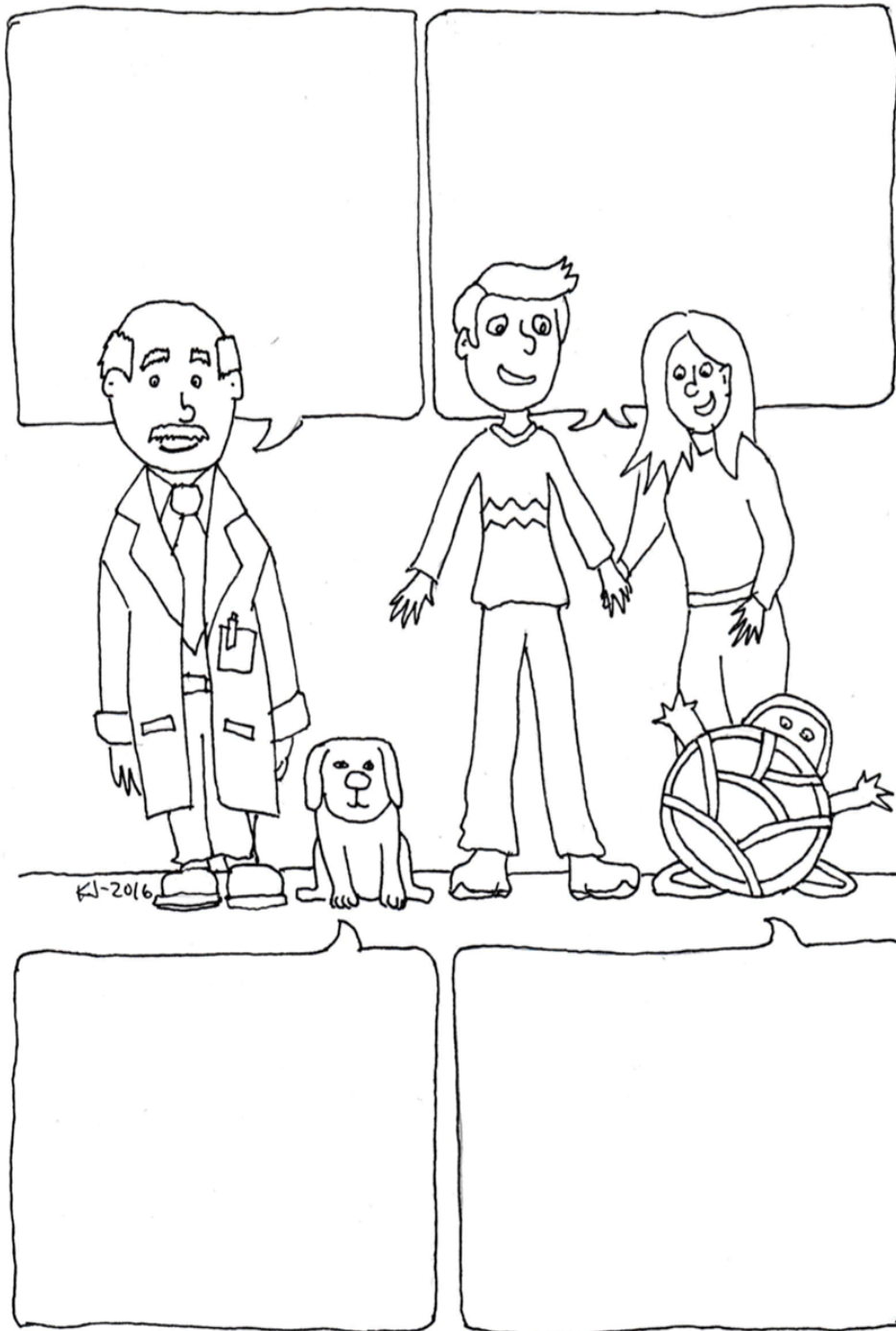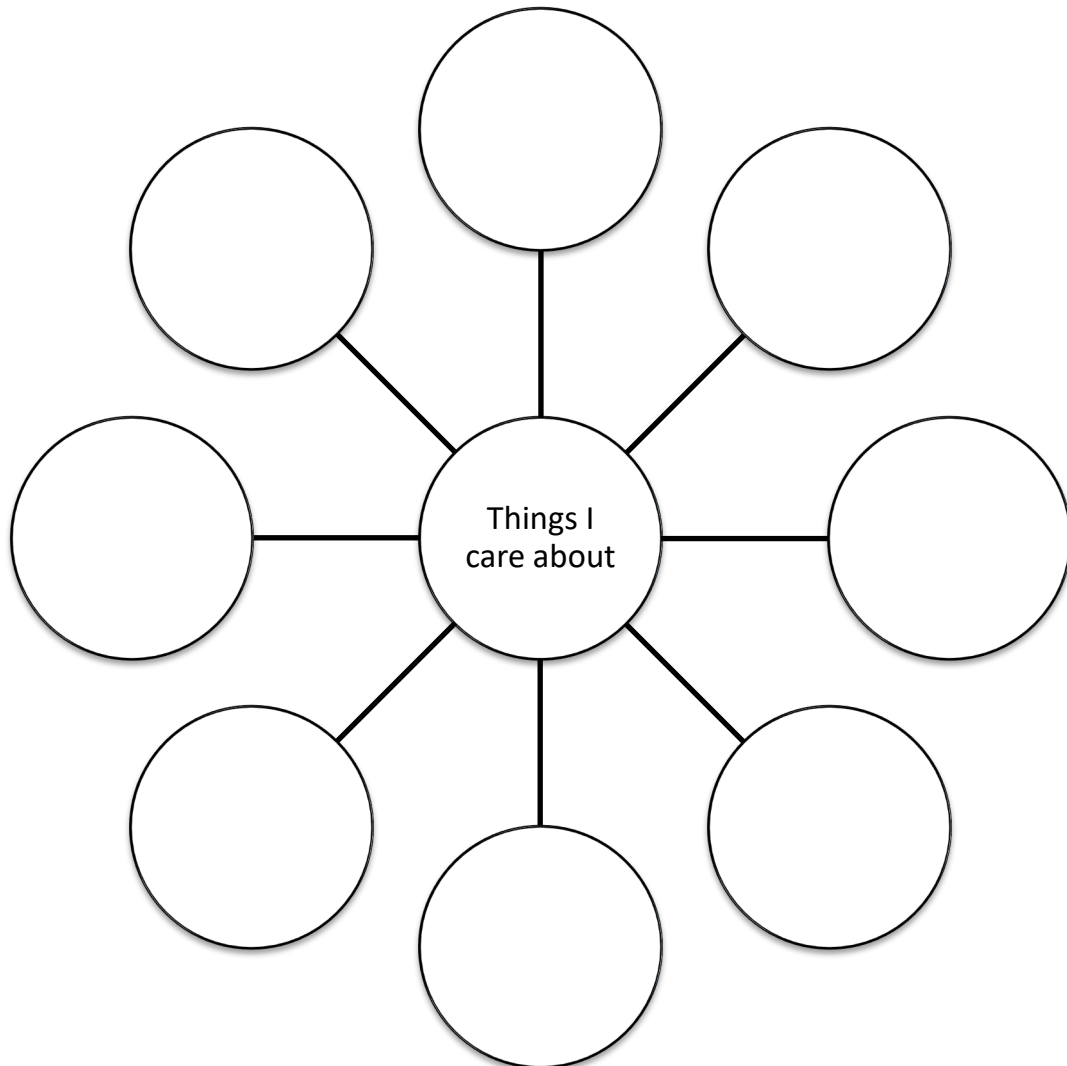Now rate how important you think each factor is (1 = not very important, 10 = very important). You can mark the numbers inside the circles. Finally, rate how well this value is being implemented in your life at the moment (1 = not at all, 10 = perfectly). Which things or values are most fulfilled in your life? Which are not so well realized? Are there any things you would like to change?

Think again: what would your best friend say if asked what is most important to you?

EXERCISE: VALUE CARDS

Which cards did you pick for yourself? What are the values that are important to you? Which of the ideas on the cards are not so important to you?

VALUE-BASED ACTIONS: WHAT ARE SOME OF THE THINGS THAT YOU THINK ARE IMPORTANT TO YOU?

Becoming aware of your values is one step. Another is to dedicate yourself to living a life in accordance with your values, thereby increasing your well-being.

EXERCISE: THE PATH OF WELL-BEING

Reflect on the things you do and how you act at the moment to maintain your well-being. Are you spending more time on things that move you toward greater well-being? Or are you perhaps doing things that are leading you toward lesser well-being?

Use the ruler on the floor to go to the point that describes your current situation. Then move to the point on the ruler where you wish you were.

EXERCISE:

If you could travel forward in time and see yourself 10 years from now, what would you want to see?

EXERCISE:

Based on your own experience, list below what you have tried to feel better.

Actions or things I do to get rid of feeling bad	Actions or things I do when I want to feel well which are in line with my values

EXERCISE: LEAVES ON A STREAM

Imagine a slow-moving stream. The water flows over rocks, meanders between trees, drops down into a valley. Occasionally a large leaf floats downstream and is carried away by the current. Imagine sitting by the stream on a warm sunny day, watching the leaves floating down the stream. Now note your own thoughts. Each time you notice a thought, imagine it is written on one of those leaves as they glide by. If words come to mind, place those words on the leaves. If images or pictures come to mind, place them on the leaves as they are.

The aim is to stay with the flow and let the leaves float by. Do not try to make the flow go faster or slower. Do not try in any way to change what is shown on the leaves. If the leaves disappear or your mind goes somewhere else, or if you find yourself in the current or on the leaves, just stop and notice that this is happening. Return to the stream again, notice the thought that comes into your mind, write it on the leaf, and let the stream take the leaf with it.

HOMEWORK:

Choose one thing based on your values that you would like to influence. Choose one step, one action, and practice it before the next meeting.

Think carefully: What could I do? With whom?
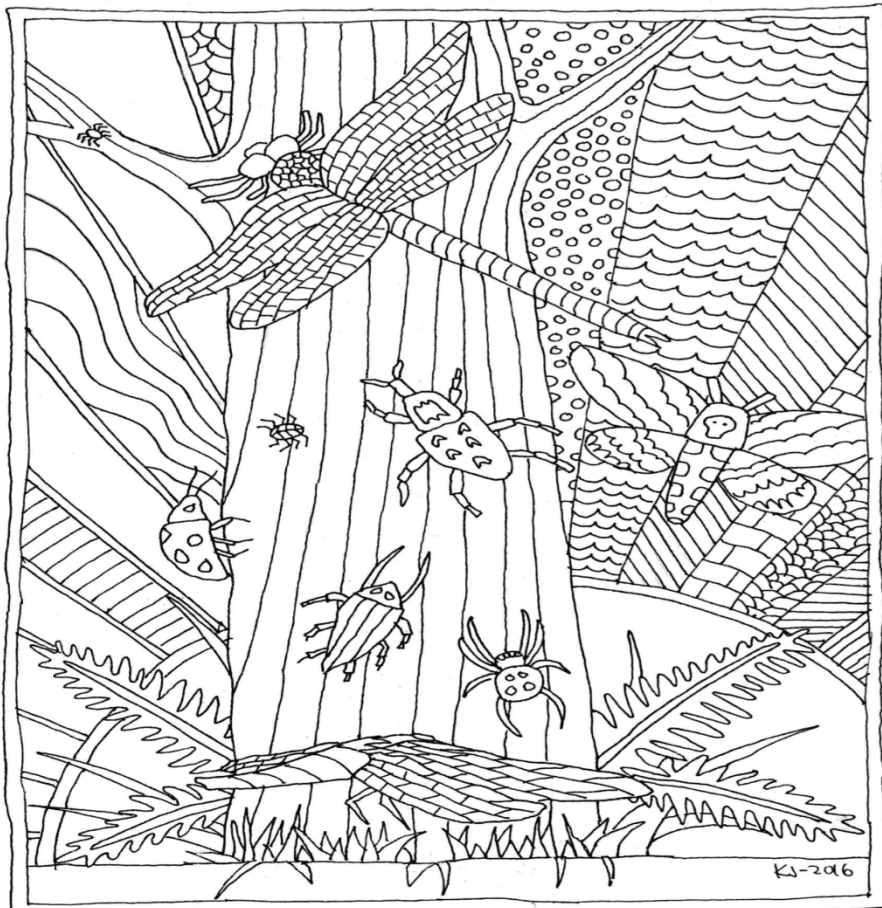
GROUP SESSION 2

CATCHING UP

REVIEW OF HOMEWORK

What did you choose to do? How did it go?

VALUE WORK - THINGS THAT ARE IMPORTANT TO YOU

EXERCISE:

Close your eyes, take a few breaths, and relax. Imagine a place where you can let your mind wander in peace. You are far in the future, 10 years from now... Now look at your life from the future. What did you most enjoy doing? What was most important to you? What could you have left undone?

Take a moment to reflect on this.

ACTIONS IN LINE WITH VALUES

Knowing your values is one step. Another is to dedicate yourself to living a life in accordance with your values, thereby increasing your well-being.

DISCUSSION: BREAKING HABITS

Think about your own routines. What do you always do the same way? Now think about which routine could you break, whether at school, at home... How do others react? How does it feel to change the way you do things?

Recount a situation where you would like to step outside the box to see or approach a problem differently from the way you see it now. How can you change what you normally do?

How will people around you react if you try to step outside the box?

EXERCISE: COMFORT AND DISCOMFORT ZONES IN THE ROOM

Go to a place in this room where you find yourself comfortable. Then, move to a place where you feel uncomfortable. Discuss.

EXERCISE: ACHIEVING REALISTIC GOALS

At the top step of the ladder, write one long-term goal for the goal you would like to achieve in six months' time. Then, on the lower rungs, write actions that will lead you to the long-term goal.

The goal for six months from now:
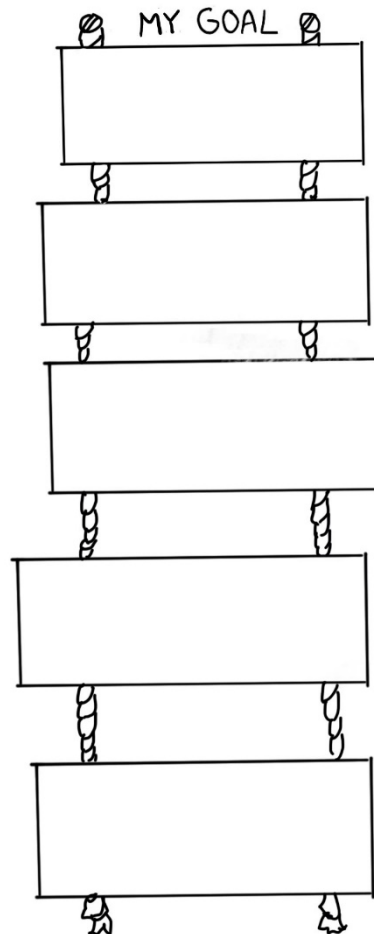
Step by step towards the goal!

THOUGHTS

EXERCISE: I CAN'T DO IT (The aim is to overcome obstacles caused by thoughts)

In this exercise, you do something while saying it out loud to yourself or thinking that you cannot do it. In other words, you do the opposite of what you tell yourself. For example: walk around the room while saying to yourself "I can't walk, I can't walk." You can also do the same when doing something you do not feel like doing, such as cleaning your room while saying to yourself "I can't clean, I can't vacuum, I can't dust, etc."

You can also apply this exercise to things that are really challenging for you. For example, if it is difficult to give a presentation at school, you can repeat "I can't give a presentation, I can't give a presentation" to yourself before the presentation. In reality, of course, you go and give the presentation and wise up to your thoughts.

EXERCISE: THE RED FERRARI

The purpose of this exercise is to show how it is extremely difficult to get rid of thoughts. When we try not to think about something, it almost automatically comes back to us again and again. Suppressing thoughts is therefore not an effective method of getting rid of the thoughts we want to get rid of. Funnily enough, unpleasant thoughts are less troublesome when you just let them come to mind.

Close your eyes. Picture a red Ferrari in front of you as clearly as you can. It is bright red! It makes a great sound. Some people have compared the sound of a Ferrari to an orchestra. It goes from a low growl to a roar in an instant. Just listen.

Now I want you NOT to think about the red Ferrari. Remember, under no circumstances do you think of a red Ferrari. I forbid you to think about it. Try to erase the red Ferrari and its sound from your mind. Think of anything but the red Ferrari. What did you think of? What did you notice? How many times did the red Ferrari cross your mind? Maybe a few times? How many times have you tried not to think about something you do not want to think about? As you found out, trying to push away and not think about a thought often does not work. What happened to the red Ferrari? And what do you think happens if you try to avoid thinking about something unpleasant?

EXERCISE: LEAVES ON A STREAM

Imagine a slow-moving stream. The water flows over rocks, meanders between trees, drops down into a valley. Occasionally a large leaf floats downstream and is carried away by the current. Imagine sitting by the stream on a warm sunny day, watching the leaves float down and the stream glide by. Now notice your own thoughts. Each time you notice a thought, imagine it is written on one of those leaves as they flow by. If words come to mind, place those words on the leaves. If images or pictures come to mind, place them on the leaves as they are.

The aim is to stay with the flow and let the leaves float by. Do not try to make the stream go faster or slower. Do not try in any way to change what is written on the leaves. If the leaves disappear or your mind goes somewhere else, or if you find your-self in the current or on the leaves, just stop and notice that this is happening. Put your attention aside and return to the stream again, notice the thought that comes into your mind, write it on the leaf, and let the stream take the leaf with it.

HOMEWORK:

1) Actions based on values (same task as the first time, to reinforce the point)

2) Actions toward better diabetes care/toward your own goals (from the ladder exer-cise)

GROUP SESSION 3
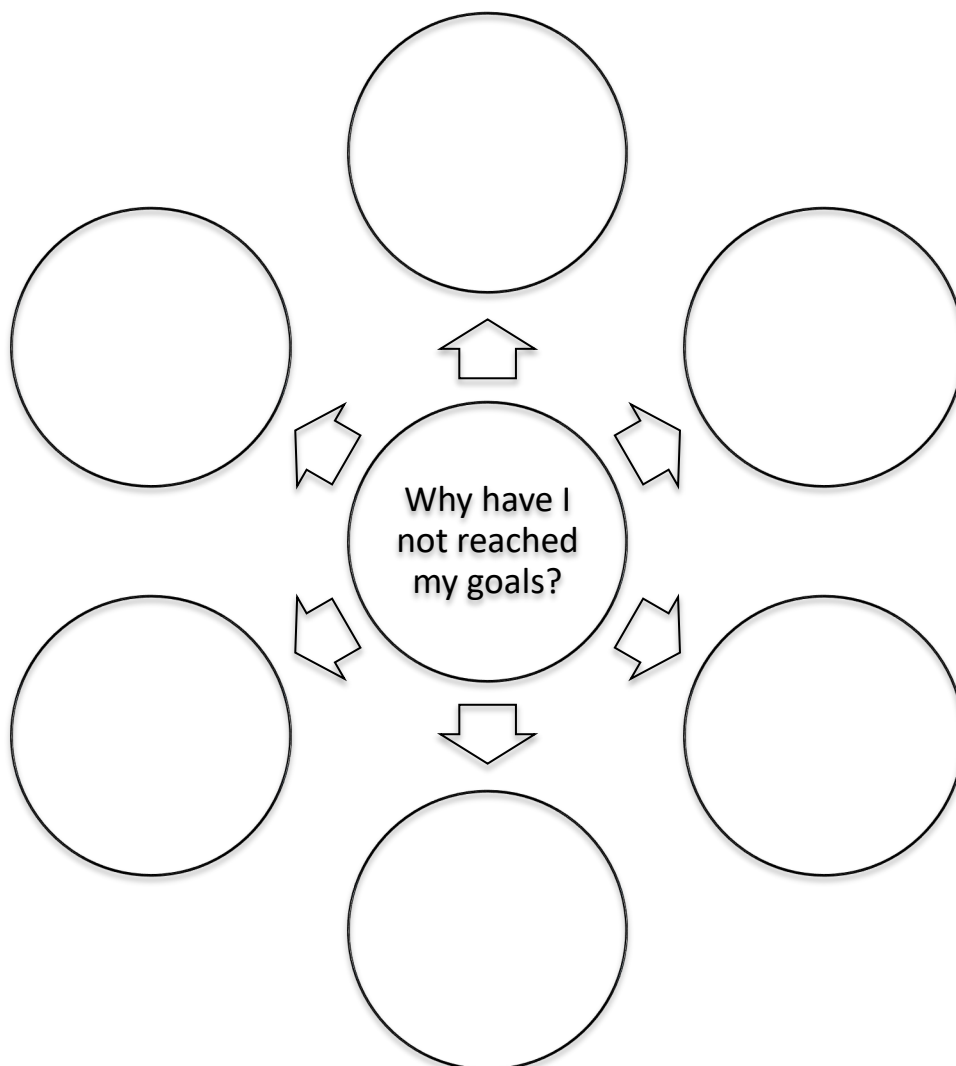
REVIEW OF HOMEWORK:

> Did you succeed in increasing values-based behavior?
> If so, how did it go?
> If not, what obstacles did you encounter?

EXERCISE: WORKING WITH OBSTACLES

Next, consider why previous attempts to achieve your goal have not been successful.

Why have I not reached my goals?

EXERCISE: IDENTIFYING OBSTACLES

Imagine you are in a rubber boat gliding along a river, the river of your life. You have chosen the river you are in and you are heading toward a life in accordance with your values. The journey is mostly calm and beautiful, but you know that there will be bumps and rough patches along the way.

When you imagine yourself traveling down this river toward a life of your values, what obstacles come to mind? What obstacles prevent you from living your values? Do thoughts come to mind that interfere with your values? Do you think you will encounter situations and events that will make it difficult to act in accordance with your values? You have been down this river before. Think of times when you faced difficulties in the past.

Think again about the obstacles you may face:

1.

2.

3.

4.

5.

PROCESSING IDEAS

EXERCISE: DISTANCE BETWEEN THOUGHTS AND FEELINGS

Think about an issue or emotion related to your problem. Now place this thing/feeling a few meters away from you in your mind and think about the following:

(write, draw, or color)

If the thing were any color, what color would it be?

What size would it be?

If it had a shape, what shape would it be?

PRESENT MOMENT SKILLS

Sometimes you feel that things are "just happening" without you really being involved, or even if you are doing something, you are "distracted." This is another skill that you can practice.

EXERCISE: MINDFUL BREATHING

Breathing, like your heartbeat, is usually automatic, yet it's the link between body and mind. Spend 5 minutes focusing on your breath, without altering it, to ease stress. Imagine it as an anchor grounding you to the present. Then, follow these steps:

- Tune into your body, noticing any sensations from head to toe.
- Observe your breath, feeling it in your belly.
- Acknowledge any feelings or thoughts without judgment, returning gently to your breath.

Reflect on the experience afterward. How did you feel? What thoughts and emotions emerged?

ACCEPTANCE

EXERCISE: TUG-OF-WAR WITH A MONSTER

"Your situation is like you and a monster pulling at opposite ends of a rope. The monster is big, ugly, and strong. There is a gap between you and the monster, and as far as you know it is bottomless. If you lose the tug-of-war, you fall into the abyss and get hurt. You pull and pull, but the harder you pull, the harder the monster pulls, and the edge of the chasm seems to be getting closer and closer. The hardest thing to understand at the moment is that the task is not to win the tug-of-war. The task is to drop the rope."
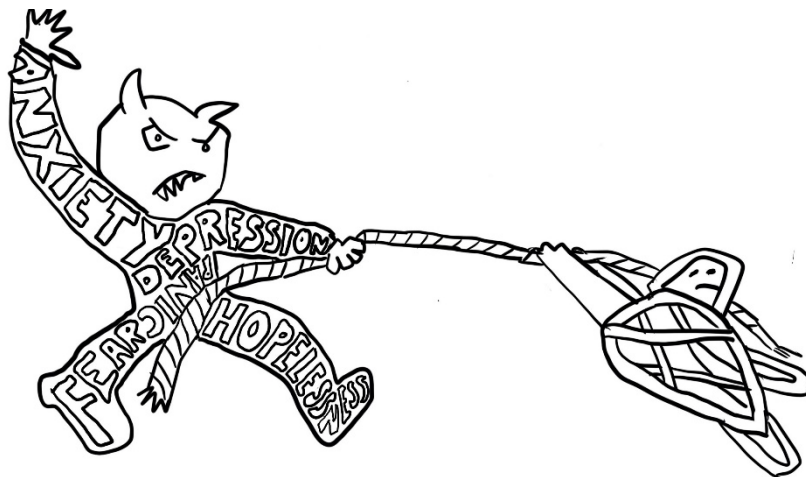
HOMEWORK:

1) Choose one thing to do that you can do MINDFULLY, such as mindfully listening to music or moving mindfully

2) Values-based action

EXERCISE: MINDFUL MOVEMENT

Practice mindful walking to become more aware of the present moment. Choose a short path or space and walk slowly for 5-10 minutes, focusing on the sensations of each step. Try to sense what it feels like to walk this way. Allow your mind to wander without judgment, then gently bring your focus back to the walk. Reflect on your experience afterwards, noticing any thoughts or feelings that arose. By integrating this practice into your daily routines, you can enhance your awareness and presence in everyday activities.

EXECISE: LISTENING TO MUSIC MINDFULLY

Practice being present by listening to your favorite song. Get comfortable, focus on the music, and observe its different elements. Give the song your full attention. Shift your attention between vocals, instruments, rhythm, and intensity.
This exercise will teach you how to observe things. Whenever you find that your mind wanders, just turn your attention back to the music.

The song I chose:

Your thoughts on the exercise:

GROUP SESSION 4

CATCHING UP

REVIEW OF HOMEWORK:

Did you succeed in increasing values-based behavior?
If so, how did it go? If not, what obstacles did you encounter?
What about the task of consciously doing?

YOU (SELF AS CONTEXT)

EXERCISE: HOUSE

You are like a house, full of furniture. Furniture is
not and can never be the same as a house. The fur-
niture is the content of the house. The house only
contains the furniture and is the place where the
furniture can be the furniture. Whether furniture is
considered good or bad says nothing about the
value of a house. You are the house, but not the fur-
niture. Your thoughts and feelings are the furniture.
Just as the furniture is not the house, your thoughts
and feelings are not you. They are experiences you
have, just like the furniture.
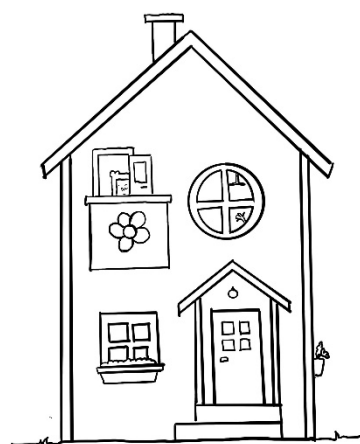
EXERCISE:

Reflect on some idea about yourself, such as "I'm
bad" or "I'm not good enough." Focus on this idea.
Then take a step back from this thought, this negative perception of yourself, and just
look at it with conscious observation. Just notice this thought and let it pass you by.
Say to yourself, "I notice that I have this thought that I am a bad person. I thank my
mind for this thought." Let the thought slip away, like the leaves sliding in the stream
in the previous exercise.

Notice how this thought, and your other thoughts, shape your perception of yourself.
This is the self-image you know best. When you discover that the perception of your-
self that your mind creates **is** a story, not an absolute truth that determines your fu-
ture, you can gain new ways of looking at yourself.

EXERCISE: THE SKY AND THE WEATHER

Think of yourself as the sky. Your thoughts and feelings are like the weather. The weather changes all the time, but no matter how stormy it is, it cannot harm the sky in any way. Even the worst thunderstorms or heavy rains will not harm it. No matter how bad the weather, there is always room for it in the sky, and sooner or later the weather will change.
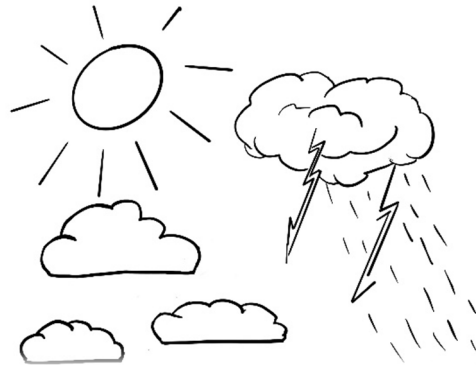
EXERCISE: DON'T THINK (about jam doughnuts)

"I'm going to tell you something I don't want you to think about: I don't want you to think about what I'm about to tell you. And when I do, don't think about it for a moment. Now you will hear it. Remember not to think about it. 'Don't think about... warm jam doughnuts. You know what they smell like when they've just been put on the plate. Don't think about it. Don't think about the taste of jam as you take a bite. Don't think about that. And the jam oozing out of the doughnut... Don't think about it. And the sugar on top of the doughnut... Don't think about it. It's very important not to think about it.'"

Did you get it? Avoiding the thought usually just makes you think about it more. The bad thing doesn't go away by just not thinking about it.

ACCEPTANCE

EXERCISE: AN UNINVITED GUEST

Imagine you are having a birthday party and you invited all your friends. The party is going great at first, but then some shady friend of a friend you don't know shows up. He's different from everyone else. He's loud, he's dirty, and he's dressed badly. You think, "Oh, why did he come?" But when you invited your friends, you told them that everyone was welcome. So could it be possible to welcome him despite everything, even if you don't like him being at the party? You can welcome him even if you don't like him. You don't have to like him. You don't have to like his behavior, his lifestyle, or his clothes. You can be annoyed by the way he drinks punch or touches the food on offer. However, you can decide whether or not he is welcome. If you decide he is not welcome, the party changes. Now you have to throw him out and then stand outside

the house guarding the door to make sure he doesn't come back. Or if you say he's welcome but don't really mean it, you might mean he's welcome as long as he stays in the kitchen and doesn't join the other guests. That way you may have to watch him all the time and you'll miss all the fun at the party. Meanwhile, life goes on, the party goes on, and you just stand guard at the door to prevent this unpleasant person from coming in. It doesn't feel like you're at a party. It's hard work.

This story is about all those feelings and thoughts that you don't like, that are like the uninvited guest at the door in the story. The important thing is the attitude you take toward your own "uninvited guests," your unpleasant thoughts. Are they welcome? Can you choose to welcome them, even if you don't like them coming? If not, what will your party be like?

EXERCISE: POP-UP THOUGHTS

The things and emotions I avoid most are ....

POP UP thoughts on paper: thoughts that pop into my mind even when I don't want to think about them:

EXERCISE: THE STONE ON THE BEACH

Sit for a while with your eyes closed, focusing on your breathing. When you are ready, think of a difficult thing or a painful memory that is bothering you at the moment. First, listen to the sensations that this thing evokes in your body. Become aware of them and observe what you find. Direct your breath to the part of your body where

you experience the sensations most intensely and respond to them with warm acceptance.

Say quietly to yourself, "This feeling is here. I accept it. I am open to it." Continue to breathe and pay full attention to your breath. You may find that your difficult feeling is initially as immense as a boulder. You may feel as if it is crushing you.

Now surround that unpleasant feeling with kindness and breathe gently toward it. Gradually you will notice how your feelings ease and the boulder shrinks to a stone. Now, in your mind, place this stone in the middle of a sandy beach. The sea gently surrounds it and the waves caress the stone in time with your breath. Breathe warmth and compassion into the stone. You will find that the stone becomes even smaller, making your own physical sensations smaller.

Reflection: Do you find yourself judging yourself? Do you notice how your body reacts to different emotional states? What do accepting yourself and listening to your body mean to you?

HOMEWORK:

1) Who or what could contribute to your goal? Could someone help you? Make a plan and carry out what you have planned.

2) Increase the number of actions that are in line with your values.
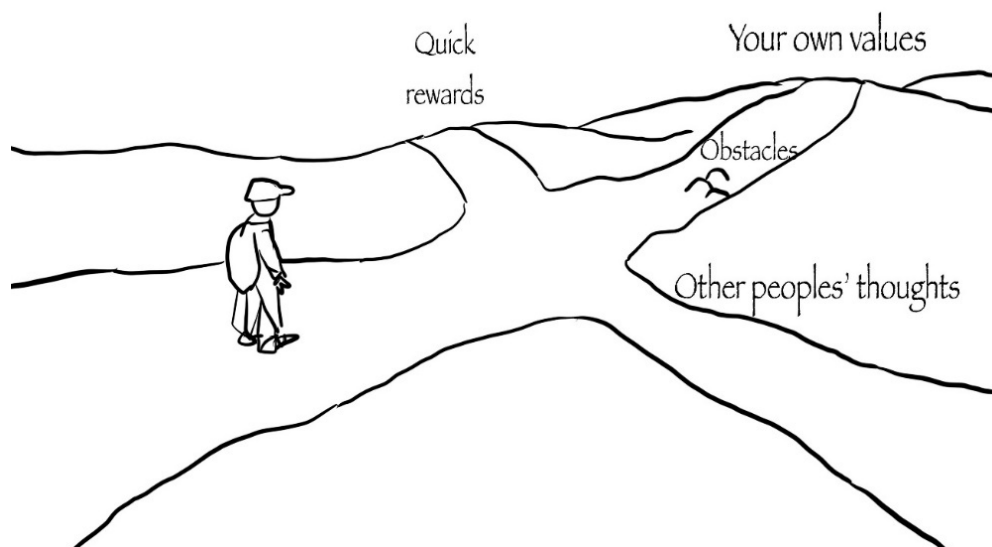
GROUP SESSION 5

CATCHING UP

HOMEWORK: How did it go?

EXERCISE: VALUE CARDS

Which cards did you pick for yourself? What are the values that are important to you?

EXERCISE: THE DIRECTION OF WELL-BEING - WHERE TO GO NOW?

Reflect on the things you do and how you act at the moment to maintain your well-being. Are you spending more time on things that move you toward greater well-being? Or are you perhaps doing things that are leading you toward lesser well-being?

Use the line on the floor and go to the point that indicates your current situation. Then move to the point on the line where you wish you were. Is there any change compared to group session 1?

DISCUSSION: How have you achieved your goals so far? What have you learned in the group? In the future, what are my goals for my own well-being?

EXERCISE: MINDFUL BREATHING

TO CONCLUDE: TAKE-HOME MESSAGES ALONG YOUR WAY: POSITIVE FEEDBACK FROM THE OTHER ADOLESCENTS

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ILLUSTRATIONS by Kimmo Jalava

ORIGINAL PAPERS

I

ADOLESCENTS WITH POORLY CONTROLLED TYPE 1 DIABETES: PSYCHOLOGICAL FLEXIBILITY IS ASSOCIATED WITH THE GLYCEMIC CONTROL, QUALITY OF LIFE AND DEPRESSIVE SYMPTOMS

by

Alho, I., Joro, M., Juntunen, L., Muotka, J., & Lappalainen, R., 2021.

Adolescents with poorly controlled type 1 diabetes: Psychological flexibility is associated with the glycemic control, quality of life and depressive symptoms

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A B S T R A C T

This study investigates the role of psychological flexibility in relation to glycaemic control (HbA1c) and quality of life among adolescents with poorly-controlled diabetes. Adolescents (n = 65, aged 12–16 years) completed the Children and Adolescents Mindfulness Measure (CAMM), the Diabetes Acceptance and Action Scale for Children and Adolescents (DAAS), the Depression Scale (RBDI), and the Health-Related Quality of Life Scale (KINDL-R). HbA1c values were collected from medical records. A higher level of psychological flexibility was associated with better glycaemic control, better quality of life, and lower levels of depressive and anxiety symptoms. Mediation analysis showed that diabetes-related psychological flexibility mediated the relationship between glycaemic control and depressive symptoms as well as quality of life. The observations in the current study support the view that adolescents with type 1 diabetes would benefit from training their psychological flexibility skills.

1. Introduction

Maintaining optimal glycaemic control in type 1 diabetes (T1D) requires intensive daily management involving checking blood glucose levels multiple times a day, multiple insulin injections or the use of an insulin pump, and careful attention to nutrition and physical activity. Metabolic control has been shown to deteriorate in adolescence as a result of pubertal and behavioural changes (Luyckx et al., 2010). In adolescence, the treatment of diabetes is often associated with neglect of self-monitoring, higher rates of ketoacidosis, and eventually microvascular complications (Insabella et al., 2007). Although the achievement of the optimal glycaemic target has both immediate and long-term health benefits, only 21% of adolescents meet the target values of HbA1c (Wood et al., 2013).

There are several psychological factors that affect diabetes management (e.g. immaturity of problem-solving skills, adolescent rebellion, and the desire to belong to peer groups without seeming different (Anderson, 2003; Insabella et al., 2007)). Additionally, shifting diabetes management responsibility from parents to youth can be demanding (Wiebe et al., 2014). Poor adjustment to diabetes in adolescence tends to persist into young adulthood (Insabella et al., 2007).

The rates of psychological symptoms have been estimated to be elevated in several studies of adolescents with T1D (Buchberger et al., 2016; Butwicka et al., 2015). Adolescents with T1D have displayed an increased incidence of anxiety, eating disorders, and depression (Kongkaew et al., 2013). In addition, distress specifically related to diabetes is common (Anderson, 2011). However, the results are mixed; a meta-analysis by Reynolds and Helgeson (2011) showed that adolescents with T1D have only slightly elevated levels of symptoms of depression and anxiety, and some studies have found no differences (Sivertsen et al., 2014).

The connection between depression and glycaemic control can be seen as reciprocal: poor glycaemic control is a risk factor for depression, and on the other hand, depression is estimated to have a negative impact on glycaemic control (Lustman & Clouse, 2005). Adolescents with depressive symptoms may have difficulties in initiating tasks for diabetes management, carrying them out, and believing they will be effective (McGrady et al., 2009). Anxiety has also been connected to glycaemic control (Buchberger et al., 2016). In general, although adolescents with T1D experience burden and worries about their illness, they still evaluate their general quality of life as being similar to their peers (Murillo et al., 2017; Nieuwesteeg et al., 2012).

One option to promote wellbeing, quality of life, and possibly glycaemic control among adolescents with T1D is to enhance their

psychological flexibility skills. This has been argued to be crucial for health as it aids individuals in handling their thoughts, feelings, and behaviours to navigate through various situations and to have a meaningful life according to one's personal values (Hayes et al., 2006; Kamody et al., 2017; Kashdan & Rottenberg, 2010).

Psychological flexibility is composed of six core processes: clarification of one's values, committed action, self as a context, defusion, acceptance, and contact with the present moment (Hayes et al., 2006). The concept of psychological flexibility is the core of Acceptance and Commitment Therapy (ACT). ACT has been successfully used in the treatment of numerous health conditions, including type 2 diabetes (Gregg et al., 2007), obesity (Lillis & Kendra, 2014), chronic pain (Wicksell et al., 2009), and depression (Kyllönen et al., 2018; Lappalainen et al., 2007).

In addition, psychological inflexibility has been found to be linked to anxiety, somatic complaints, problem behaviours, and decreased quality of life among adolescents (Greco et al., 2008), and psychological flexibility has been found to be connected to emotional wellbeing and prosocial skills among 14–16-year-old adolescents (Ciarrochi et al., 2011). Problems in the treatment of adolescents with T1D have been proposed to be connected to psychological inflexibility, especially to experimental avoidance and defusion (Hadlandsmyth et al., 2013). An adolescent might, for example, avoid treatment when around other people to avoid difficult thoughts like, "Other people think that I'm different." In line with this, high acceptance of thoughts and emotions related to diabetes has been connected to lower HbA1c values and better quality of life among type 1 and 2 diabetes patients (Misra & Lager, 2008; Richardson et al., 2001). A diabetes-avoidance coping style has been associated with infrequent blood glucose monitoring (Weijman et al., 2005). Similarly, adolescents who use avoidant coping styles have been shown to experience more diabetes-specific distress, to be less likely to adhere to treatment, and to have poorer glycaemic control (Iturralde et al., 2017). Overall, relatively few studies have been conducted concerning psychological flexibility in adolescents with T1D, and more studies are needed.

It has been suggested that glycaemic control has an impact on the moods of adolescents (Buchberger et al., 2016). Also, earlier studies (Li et al., 2019) have shown evidence that chronic illness can contribute to elevated depressive symptoms and anxiety and weaken quality of life. Meta-analyses have suggested that children with chronic illness have higher levels of behavioural and social problems, including anxiety and depression, than healthy peers (Pinquart & Shen, 2011) and, further, that children with chronic illness tend to under-report their symptoms (Pinquart & Shen, 2011). As a consequence, it has been recommended that clinicians screen for psychological distress among children with chronic physical illness, and that future studies should analyse the interplay of processes that mediate the effect of chronic illness on behavioural problems (Pinquart & Shen, 2011).

The aims of the present study were to determine among adolescents with T1D: (1) whether glycaemic control is associated with quality of life, and depression and anxiety symptoms; (2) whether high psychological flexibility is associated with better glycaemic control and better quality of life; and (3) whether psychological flexibility mediates the relationship between glycaemic control (independent variable), and quality of life and depressive and anxiety symptoms (dependent variables).

Based on earlier Research, regarding our aim 1, it was hypothesized that better glycaemic control would be associated with better quality of life (Li et al., 2019; Pinquart & Shen, 2011). Concerning aim 2, it was expected that high psychological flexibility would be associated with better glycaemic control and quality of life. In addition, we expected psychological skills to mediate the relationship between chronic disease and psychological distress and quality of life. First, based on previous findings (e.g. Li et al., 2019; Pinquart & Shen, 2011) it was assumed that there is a causal relationship between chronic illness (in the current study, poorly managed T1D) and symptoms of depression and anxiety as

well as quality of life (path c in the mediation model, Fig. 1). Second, we proposed, based on earlier findings (Hadlandsmyth et al., 2013), that adolescents with T1D show psychological inflexibility and a tendency towards experimental avoidance and defusion (path a, Fig. 1). Third, we proposed regarding path b (Fig. 1), that adolescents who use avoidant coping styles (report low flexibility) experience more diabetes-specific distress and poorer glycaemic control and quality of life (Iturralde et al., 2017; Misra & Lager, 2008; Richardson et al., 2001; Weijman et al., 2005). Thus, we expected that psychological flexibility would mediate the relationship between chronic illness (e.g. glycaemic control), and psychological symptoms and quality of life (indicated by a significant indirect effect in path a x b, Fig. 1).

2. Materials and methods

The current article is a part of a larger study investigating the use of an ACT-based group intervention for adolescents with type 1 diabetes. This paper presents the findings from the pre-measurements prior to the intervention. The study was conducted at the paediatric outpatient clinic of the Central Finland Health District in cooperation with the University of Jyväskylä.

2.1. Participants and recruitment

All 12–16-year-old adolescents with T1D within the diabetes clinic whose HbA1c was above the recommendation (7.5%) at the paediatric outpatient clinic were invited to participate. The exclusion criterion was current psychiatric or psychological treatment. Recruitment was conducted during the visits to the paediatric clinic. Oral and written information about the study was given, and written informed consent was obtained. Ethics approval was obtained from the Research Ethical Committee of the Central Finland Health Care District (reference number #7U2015). Thirteen adolescents cancelled participation before pre-measurement for unknown reasons (seven females, six males, mean HbA1c = 9.38%). Table 1 describes the background information of the participants (n = 65) who took part in the current study. All participants were Caucasian and Finnish-speaking.
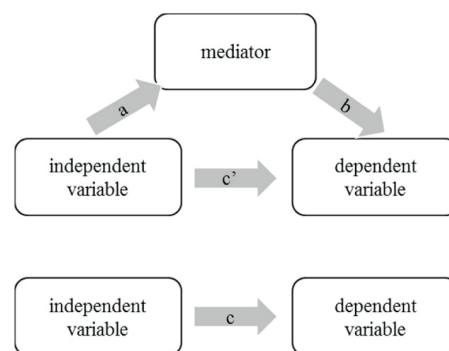
a = the effect of independent variable on mediator
b = the effect of mediator on dependent variable
c = total effect of independent variable on dependent variable = ab+c'
c'= direct effect of independent variable on dependent variable

Fig. 1. Simple mediation model (Preacher & Hayes, 2008).

Table 1
The background information of the participants (n = 65).

	Male (n = 24) 36.9%	Female (n = 41) 63.1%	All (n = 65)
Age Mean (sd)	13.29 years (1.12)	13.63 years (1.22)	13.51 years (1.19)
12–13 years	n = 13	n = 19	n = 32
14–16 years	n = 11	n = 22	n = 33
Illness duration Mean (sd)	6.59 years (3.85)	6.78 years (4.30)	6.71 years (4.11)
Min.-max. values	0.4–12.75 years	0.4–15.0 years	0.4–15.0 years
95%CI	5.03–8.17	5.50–7.96	5.67–7.71
HbA1c[a] Mean (sd)	9.19% (1.94)	9.48% (1.76)	9.34% (1.83)
Min.-max. values	6.8%–15.80%	6.3%–14%	6.3%–15.8%
95%CI	8.37–9.94	8.95–10.06	8.91–9.79

[a] Recommended blood glucose level < 7.5%.

3. Measures

3.1. Glycaemic control

HbA1c is a commonly-used marker of glycaemic control, and it is used as a general indicator to reflect the average blood glucose levels of the preceding weeks/months. HbA1c values were obtained from the medical records, and the most recent value, collected within a period of two months, was used.

3.2. Quality of life

To measure quality of life, the Revised Children's Quality of Life Questionnaire (KINDL-R) was used (Ravens-Sieberer & Bullinger, 1998). We used the generic, youth-specific module consisting of 24 questions and the diabetes-specific module consisting of 17 questions (41 items total). The generic module consists of the following areas: physical wellbeing, emotional wellbeing, self-esteem, family–social, and school. The answers were given on a Likert scale from 1 to 5. The subscales were combined to form a total score with a maximum of 120 in the generic module and 85 in the diabetes module, with higher scores indicating better QoL. For the analysis, the scores were scaled from 0 to 100 points. Cronbach's alpha was 0.91 for general QoL and 0.87 for diabetes-related QoL.

3.3. Symptoms of depression and anxiety

To measure symptoms of depression and anxiety, we used the Revised Beck Depression Inventory (RBDI), a Finnish modification of the 13-item version of the BDI (Beck & Beck, 1972). It consists of 13 questions measuring depressive symptoms and one question measuring anxiety (Raitasalo, 2007). In each question, there are five possible answers to choose from, and scores are given from 0 to 3. The maximum score for depressive symptoms is 39. Scores under 5 indicate no symptoms, scores between 5 and 7 indicate mild symptoms, scores between 8 and 15 indicate moderate symptoms, and scores above 16 indicate severe depressive symptoms. The maximum score for the question measuring anxiety is 3. The score indicates possible anxiety and its severity (1 for mild, 2 for moderate, and 3 for severe anxiety symptoms). Cronbach's alpha for the measurement was 0.93.

3.4. Psychological flexibility

Psychological flexibility was measured using the Child and Adolescent Mindfulness Measure (CAMM) and the Diabetes Acceptance and Action Scale for Children and Adolescents (DAAS).

CAMM was developed to measure general mindfulness and

acceptance skills, and it assesses the degree to which children and adolescents observe their internal experiences, act with awareness, and accept internal experiences without judging them (Greco et al., 2011). We used the 10-question version, consisting of statements such as "At school, I walk from class to class without noticing what I'm doing," or "I push away thoughts that I don't like." The answers are given on a Likert scale from 0 to 4, and the maximum score is 40. Higher scores indicate higher levels of general mindfulness and acceptance. Cronbach's alpha for the measurement was 0.84.

Diabetes-related acceptance was measured with DAAS, developed by Greco and Hart (2005). The questionnaire consists of 42 questions, and responses are given on a Likert scale from 0 to 4; the maximum score is 168. It includes statements such as, "I do things that are important to me even though I have diabetes." The questionnaire assesses constructs such as acceptance, cognitive fusion, and experimental avoidance. In particular, DAAS measures how the child handles their feelings related to diabetes and whether the child uses avoidance strategies when dealing with their diabetes. A higher sum refers to higher psychological flexibility, better acceptance of diabetes, and more action (Greco & Hayes, 2008). The Finnish version was translated from English by the authors, with permission from Dr Laurie Greco. Cronbach's alpha for the measurement was 0.91.

3.5. Statistical analysis

Data analyses were carried out using the IBM SPSS statistics program, version 26. To describe the investigated sample, the number of participants classified with mild, moderate, and severe symptoms of depression and anxiety was reported. Additionally, QoL measures (mean, standard deviation, 95% CI) were compared to the available reference values of a German population of adolescents of the same age (n = 1895; Ravens-Sieberer et al., 2008) because a Finnish reference group was not available. Correlation coefficients were used to examine the associations between the variables. Correlations with r ≥ 0.50 were regarded as strong and r ≥ 0.30 as moderate (Kraemer et al., 2003).

We conducted mediation analyses (see Fig. 1) using bootstrapping (Preacher & Hayes, 2008) to determine whether psychological flexibility mediates the relationship between glycaemic control (the independent variable), and QoL and depressive and anxiety symptoms (the dependent variables). In the analysis, the effect of gender was controlled since it is known that adolescent girls have more symptoms of depression and anxiety and report lower quality of life (Cavallo et al., 2006; Hood et al., 2006).

Mediation exists when the independent variable (HbA1c level) is associated with the dependent variable (e.g. QoL) indirectly through the mediator (DAAS). Using 1000 bootstrap resamples, 95% bias-corrected bootstrap confidence intervals were derived for indirect effects. If the lower and upper bounds did not contain zero, the indirect effect was considered significant. We also calculated the percentage of mediation (a x b/c) to estimate the proportion of the total relationship between the X and the Y explained by the indirect effect. Fig. 1 illustrates the mediation model. In our hypothesized mediation model, our predictor variable was glycaemic control (X), the mediator was diabetes-related psychological flexibility (DAAS), and our outcome variables were QoL and depressive and anxiety symptoms.

Power analysis for the mediation analysis was conducted post hoc by using M+ software (version 8.4) and Monte Carlo simulations with 10,000 replications. We applied two models in order to investigate the power in our mediation analysis. The first model included the average blood glucose levels (IV= HbA1c), symptoms of depression (DV), and diabetes-related flexibility (DAAS) as the mediator. The power for indirect effects was 0.877, and the power for the total direct effect was 0.761. The second model included the average blood glucose levels (IV= HbA1c), general quality of life (DV), and diabetes-related flexibility (DAAS) as the mediator. The power of the indirect effect was 0.875, and the power of the total direct effect was 0.623. A power of 0.80 is

estimated to be sufficient. This indicated that our sample size was large enough to obtain significant mediation effects (e.g. Hinton et al., 2004). The mediation analysis was not conducted on general psychological flexibility (CAMM) because the power was lower than desired (<0.80). The power for the indirect effect was 0.570 and for the total effect 0.622 when IV = HbA1c and DV = quality of life.

4. Results

4.1. Symptoms of depression and anxiety and quality of life

At least mild depressive symptoms were reported by 20% of participants, and at least mild anxiety symptoms were noted by 39%. Symptoms of depression and anxiety are presented in Fig. 2. Table 2 describes the means, confidence intervals, and minimum and maximum values of quality of life (QoL). Based on the 95% confidence intervals (Table 2), the general level of QoL, the level of QoL related to self-esteem, friends and school were higher in our group than in the healthy reference group (Ravens-Sieberer et al., 2008). The other dimensions of QoL did not differ from the non-diabetic reference group.

Is glycaemic control associated with depressive symptoms and anxiety as well as with quality of life?

Glycaemic control (HbA1c) correlated significantly with the level of symptoms of depression and anxiety; the higher the HbA1c (i.e. poorer control), the higher the level of symptoms (Table 3). The correlations were moderate ($r \geq 0.30 < 0.50$). Glycaemic control was significantly associated with general QoL, QoL related to self-esteem, QoL at school, and with diabetes-related QoL. The correlations varied from small to moderate ($r = 0.25–0.47$). Thus, the higher the HbA1c (i.e. poorer control), the lower the QoL (Table 3).

Is psychological flexibility associated with symptoms of depression and anxiety, quality of life, and glycaemic control?

Psychological flexibility (both general and diabetes-related) correlated moderately or strongly ($r = 0.36–0.64$) with symptoms of depression and anxiety (Table 3). Thus, a higher level of psychological flexibility was associated with lower levels of symptoms. Psychological flexibility (both general and diabetes-related) was significantly correlated with all dimensions of QoL. The correlations were moderate or strong ($r = 0.33–0.76$). In particular, diabetes-related flexibility (DAAS) correlated strongly with many dimensions of QoL (emotional, self-esteem, school, diabetes). This suggests that the higher the psychological flexibility skills, the higher the QoL (Table 3). Psychological flexibility also correlated significantly and moderately with glycaemic

control. The higher the level of psychological flexibility, the better the glycaemic control (lower HbA1c).

4.2. Psychological flexibility as a mediator

Table 4 shows the outcomes of the mediation analysis. The results indicated that diabetes-related psychological flexibility (DAAS) mediated the relationship between glycaemic control and depressive symptoms. For anxiety, the mediation effect was not found. Diabetes-related psychological flexibility also mediated the relationship between glycaemic control and quality of life, including general QoL and all the subscales.

We also calculated the percentage of mediations to estimate the proportion of the total relationship between X and Y explained by the indirect effect (Table 4). DAAS explained 69% of the total relationship between glycaemic control and depressive symptoms and 86% of the relationship between glycaemic control and general quality of life (QoL). Among the subscales of quality of life, the largest proportion explained was found for the subscales of QoL related to family (85%) and self-esteem (78%).

5. Discussion

Among adolescents with poor glycaemic control, psychological flexibility was associated with glycaemic control: the higher the psychological flexibility skills, the better the glycaemic control. In line with this, Hadlandsmyth et al. (2013) proposed that problems in the treatment of diabetes in adolescence could be related to psychological inflexibility. Attempts to avoid facing problems through behavioural or emotional disengagement or avoidance are a way for adolescents with diabetes to handle difficulties (Jaser & White, 2011). Avoidance of diabetes treatment, such as delaying checking blood glucose or taking insulin, may offer momentary relief from the negative emotions associated with diabetes. The avoidance pattern may, however, lead to an attitude of diabetes being unmanageable, as well as feelings of guilt. Diabetes-related distress may interfere with further self-management and weaken glycaemic control (Iturralde et al., 2017).

In the current study, psychological flexibility was also associated with the quality of life of the adolescent and the levels of depressive and anxiety symptoms. There is previous Research supporting psychological flexibility being connected to depressive (Plumb et al., 2004) and anxiety symptoms (Karekla et al., 2004) and quality of life (Di Battista et al., 2009), and our results are in line with these studies.
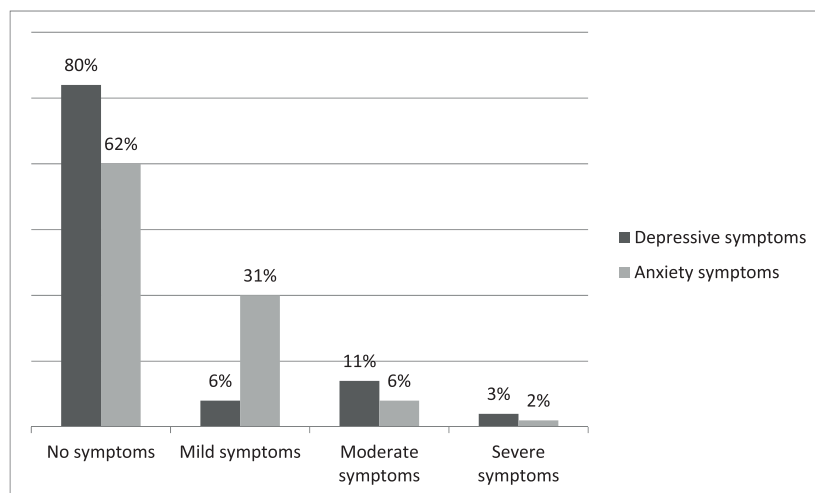

Fig. 2. Depressive and anxiety symptoms of the adolescents (n = 65).

Table 2

General and different dimensions of quality of life. Means, standard deviations (SD), confidence intervals (95% CI), and minimum and maximum values in the current study (n = 65) and reference values from a German study are presented (* = Ravens-Sieberer et al., 2008; N = 1895).

	Diabetes population in this study					Non-diabetic reference group*		
	Mean	SD	95% CI	min.	max.	Mean*	SD*	95% CI
KINDL General	76.53	10.65	73.82–79.06	37.50	94.17	73.00	10.20	72.53–73.47
KINDL Physical	74.94	14.23	71.02–78.40	30	100	70.70	16.80	69.93–71.47
KINDL Emotional	79.08	12.12	76.08–81.84	35	100	81.60	12.60	81.03–82.18
KINDL Self Esteem	68.38	15.96	64.31–71.92	25	100	58.40	18.30	57.56–59.24
KINDL Family	83.23	15.14	79.15–86.85	30	100	82.50	15.30	81.80–83.20
KINDL Friends	81.23	12.06	78.54–84.38	45	100	77.50	14.60	76.83–78.17
KINDL School	72.69	14.84	69.16–76.08	30	100	67.20	16.90	66.42–67.98
KINDL Diabetes	75.82	14.04	72.42–79.17	31.76	98.82	–	–	–

KINDL= Health-Related Quality of Life Scale.

Table 3

The correlations between psychological flexibility and glycaemic control (HbA1c), and general QoL and different dimensions of QoL and. Depressive and anxiety symptoms of the adolescents (n = 65).

	KINDL General (sum)	KINDL Physical	KINDL Emotional	KINDL Self Esteem	KINDL Family	KINDL Friends	KINDL School	KINDL Diabetes	RBDI depr.	RBDI anx.	HbA1c
DAAS	0.64**	0.34**	0.53**	0.53**	0.45**	0.38**	0.67**	0.76**	−0.45**	−0.45**	−0.39**
CAMM	0.58**	0.41**	0.44**	0.44**	0.33**	0.47**	0.58**	0.54**	−0.49**	−0.36**	−0.31*
HbA1c	−0.29*	−0.16	−0.18	−0.25*	−0.20	−0.04	−0.43**	−0.47**	0.33**	0.43**	–

* = p < 0.05, ** = p < 0.01.
DAAS = Diabetes Acceptance and Action Scale for Children and Adolescents.
CAMM= The Child and Adolescent Mindfulness Measure.
KINDL = Health-Related Quality of Life Scale.

Table 4

Direct and indirect effects of depressive and anxiety symptoms and quality of life on glycaemic control (HbA1c) using diabetes-related psychological flexibility (DAAS) as the mediator (indirect effect).

X Independent variable	Y Dependent variable	M mediator	a path coefficient	b path coefficient	Total effect (c)	Direct effect (c')	Indirect effect (ab)	Indirect Effects CI (95%) Lower	Upper	Percent mediation
HbA1c	Depressive symptoms	DAAS	−3.99**	-.15***	.87*	.27	.59	.19	1.60	69%
	Anxiety	DAAS	−3.99**	-.01*	.15***	.11**	.04	-.001	.11	25%
	General QoL	DAAS	−3.99**	.32***	−1.50*	-.21	−1.31	−2.78	-.45	86%
	QoL Physical	DAAS	−3.99**	.21*	−1.10	-.24	-.86	−2.51	-.02	78%
	Qol Emotional	DAAS	−3.99**	.31***	−1.02	.23	−1.27	−2.77	-.41	–
	QoL self-esteem	DAAS	−3.99**	.39***	−2.00	-.43	−1.55	−3.08	-.52	79%
	QoL family	DAAS	−3.99**	.34**	−1.59	-.25	−1.38	−3.10	-.04	85%
	QoL friends	DAAS	−3.99**	.23**	-.067	.86	-.91	−2.36	-.24	–
	QoL school	DAAS	−3.99**	.43***	−3.36***	−1.65*	−1.72	−3.56	-.64	51%
	Diabetes-related QoL	DAAS	−3.99**	−46***	−3.34***	−1.49*	−1.86	−3.24	-.68	55%

* = p < .05, ** = p < .01, *** = p < .001 DAAS = Diabetes Acceptance and Action Scale for Children and Adolescents.
Notes: 1) Indirect effects were analysed by bootstrapping 2) Percent mediations for two of the subscales of QoL (emotional and friends) could not be calculated due to inconsistent mediation.

Based on earlier findings (e.g. Li et al., 2019; Pinquart & Shen, 2011) we assumed that there is a causal relationship between poorly-managed diabetes, and symptoms of depression and anxiety, and quality of life. Further, based on previous evidence, we proposed that psychological flexibility would mediate this relationship. Our findings supported our assumptions for the most part. Diabetes-related psychological flexibility mediated the relationship between glycaemic control and depressive symptoms, as well as quality of life. In fact, how the child handles emotional reactions related to diabetes, and whether the child uses avoidance strategies or not when dealing with diabetes (as measured by

DAAS), mediated a great amount of the association between glycaemic control and quality of life. A high proportion of the total relationship between glycaemic control and quality of life relating to family and self-esteem was explained by DAAS. However, anxiety was not mediated by psychological flexibility, which was against our hypothesis. The mediation was marginally not significant (CI -0.001; 0.11); however, it is possible that with a larger study population, the mediation would have been significant.

In our study, the diabetes-related psychological flexibility measure, DAAS, appeared to be a useful instrument for obtaining knowledge of

adolescents' thoughts and emotional reactions towards diabetes. Further, the DAAS correlated strongly with quality of life. Based on the current findings, we recommend clinicians use DAAS or an equivalent measure in order to obtain information on an adolescent's attitudes and behavioural patterns towards their diabetes. Further, diabetes-related psychological flexibility was associated with glycaemic control, suggesting that diabetes-related psychological flexibility (e.g. how the child handles their feelings related to diabetes and whether the child uses avoidance strategies when dealing with their diabetes) could be a potential target for intervention among adolescents with poor glycaemic control.

When compared to Finnish adolescents in general (Strandholm & Ranta, 2013; Wargh et al., 2015), the prevalence of moderate or severe depressive and anxiety symptoms was not higher among the group of adolescents investigated in this study. Also, quality of life was not lower in our sample compared to the non-diabetic reference group.

Glycaemic control was significantly associated with general quality of life, diabetes-related quality of life, and quality of life related to school and self-esteem; the higher the HbA1c, the lower the quality of life. There are other studies supporting this observation, showing that good glycaemic control has been connected to better quality of life (Hilliard et al., 2013). As reported above, we found that poorer control of diabetes (higher HbA1c) was associated with lower school-related quality of life. Adolescents spend long days at school and need to take care of their diabetes during lunch, breaks, gym, and other activities. This tends to be difficult for many adolescents who do not want to look different from their peers. Avoiding diabetes treatment in social situations may worsen the self-management of the illness.

Poorer glycaemic control was associated with a higher level of anxiety and depressive symptoms. This is consistent with previous studies (Buchberger et al., 2016; Hassan et al., 2006; Kongkaew et al., 2013). The co-occurrence of depression and anxiety with diabetes can worsen the quality of life (Goldney et al., 2004) and potentially predispose the individual to problems in adulthood (Insabella et al., 2007). In clinical practice, in addition to diabetes-related psychological flexibility, it is important to pay attention to symptoms of depression and anxiety as well as quality of life among adolescents with type 1 diabetes.

One significant limitation of the current study is the small sample size, which limits the generalizability of the results. The power analysis was conducted for the mediation analysis, and the power was estimated to be sufficient. However, this limitation must be observed when drawing conclusions from the current data since it has been shown that the between-study heterogeneity estimate can decrease or alternatively increase when underpowered studies have been excluded from the meta-analyses. This is probably due to the fact that underpowered studies tend to observe more extreme effect estimates. This can increase the possibility that underpowered studies often show different results compared to larger studies (Turner et al., 2013).

It also needs to be observed that the pre-measurement of an intervention study was used in the current study, and the exclusion criterion for participation was regular psychiatric or psychological contact, which may have affected the results. Also, these findings represent adolescents with poorly-controlled diabetes and their families who were motivated to participate in an intervention study. This can have an effect on generalizing the results to all adolescents with T1D. Measures were based on a limited number of self-reports, and they measure what is asked in specific questions included in the measure. Finally, due to the cross-sectional nature of the data, we need to be cautious in drawing causal relations based on the current findings.

In summary, we observed that psychological flexibility skills were associated with glycaemic control, quality of life, and depressive and anxiety symptoms among adolescents who poorly manage their diabetes. Diabetes-related psychological flexibility skills also mediated the associations between glycaemic control and quality of life and the levels of depression symptoms. Thus, interventions aiming to increase psychological flexibility skills could be useful for enhancing diabetes management and quality of life among adolescents with poorly-controlled diabetes.

Declaration of competing interest

Acknowledgements

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II

ACCEPTANCE AND COMMITMENT THERAPY GROUP INTERVENTION FOR ADOLESCENTS WITH TYPE 1 DIABETES: A RANDOMIZED CONTROLLED TRIAL

by

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Acceptance and commitment therapy group intervention for adolescents with type 1 diabetes: A randomized controlled trial

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ABSTRACT

Type 1 diabetes can be a challenging disorder to manage, and it needs a significant amount of self-care and daily management. Management tends to deteriorate during adolescence due to both physiological and psychological factors. This study aimed to investigate the use of methods based on acceptance and commitment therapy (ACT) for the purpose of increasing well-being, psychological flexibility, and motivation regarding treatment among adolescents whose glycosylated hemoglobin was above the recommended value. This study is one of the first to examine the impact of an ACT-intervention on glycemic control.

In this pilot study, we developed an ACT-based group intervention and invited 12–16-year-old adolescents at a pediatric diabetes outpatient clinic to join the study. Participants demonstrating difficulty managing their diabetes were randomized into either the ACT+Treatment-as-usual group (ACT+TAU, n = 36) or the TAU only group (n = 36). The intervention participants were offered a five-session ACT-based group intervention. The program consisted of structured group sessions held every two weeks and voluntary homework. Glycosylated hemoglobin (HbA1c) levels were monitored for both groups as well as diabetes-related psychological flexibility, acceptance and mindfulness skills, symptoms of depression and anxiety, and quality of life. The questionnaires were completed at the start and end of the program, and the HbA1c values were collected from the medical records.

Compared to the TAU group, the ACT+TAU group showed significantly larger changes in glycemic control (between-group Cohen's $d = 0.59$), diabetes-related psychological flexibility ($d = 0.29$), and symptoms of anxiety ($d = 0.48$). There was no significant effect on depression, mindfulness and acceptance skills, or quality of life. All the adolescents reported being satisfied with the group, and 97% were willing to recommend it to others.

Based on these initial findings, the acceptance-, mindfulness-, and value-based model seems to be suitable for adolescents with type 1 diabetes who have difficulty controlling their chronic illness. Adding a psychological group-based intervention to standard (TAU) diabetes care for adolescents could increase treatment compliance.

1. Introduction

1.1. Type 1 diabetes and adolescence

Adolescence is a crucial period in life during which individuals are confronted with various developmental challenges. In addition to normative developmental challenges, young people with chronic illnesses are confronted with non-normative challenges, such as integrating a chronic condition into their daily life (Oris et al., 2016). Type 1 diabetes (T1D) is a serious chronic illness that requires lifetime adherence to numerous disease care behaviors. Successful management of

T1D requires an intensive daily regimen that involves checking blood glucose levels several times a day, multiple insulin injections or use of an insulin pump, and attention to nutrition and physical activity. To prevent acute and long-time complications, the daily regimen should be followed closely; however, many adolescents struggle with this: Only 17% of adolescents meet the current glycemic target (HbA1c of <7.5%) for children (American Diabetes Association, 2021). Metabolic control has been shown to deteriorate in adolescence as a result of pubertal and behavioral changes (Luyckx et al., 2010), and poor adjustment to diabetes in adolescence tends to continue into young adulthood (Insabella et al., 2007).

1.2. Acceptance and commitment therapy and psychological flexibility

Behavioral factors and motivation are known to be essential in the treatment of diabetes, and various psychological interventions for adolescents with T1D have been studied, for instance, coping skills training, family intervention techniques, motivational interviewing, cognitive behavioral therapy (CBT), psycho-education, and multisystem therapy. These programs have shown that psychological interventions can improve patients' control of glycemic levels (Aljawarneh at al., 2020). Among the group of cognitive behavioral therapies, acceptance and commitment therapy (ACT; Hayes et al., 1999) has shown promising results in a range of health-related areas and has been proposed as especially suitable for adolescents (Hadlandsmyth et al., 2013). ACT is a behavior analytically derived intervention approach, which belongs to the group of third-wave behavior CBT therapies—that is, a more recent generation of functional contextual psychotherapy approaches (Hayes et al., 1999, 2006). The main purpose of ACT is to promote psychological flexibility (Hayes et al., 2006), a concept referring to one's ability to accept one's own difficult thoughts and feelings while also striving to live a meaningful life according to one's personal values (Hayes et al., 2013). Psychological flexibility has been argued to be crucial for health as it aids individuals in utilizing their thoughts, feelings, and behaviors to navigate various situations for the most optimal outcomes (Kamody et al., 2017; Kashdan & Rottenberg, 2010).

Psychological flexibility can be established through six core processes: values, committed action, the self as a context, defusion, acceptance, and contact with the present moment. Each of these processes is a psychological skill that can be trained and enhanced (Hayes et al., 2006). *Values* refer to chosen qualities of purposive action that cannot be obtained as an object but can be instantiated moment by moment. They are not to be reached but, instead, used to guide behavior about the best choices to take in life. *Committed action* refers to the patterns of effective action linked to chosen values that lead to value-directed living. The *self as a context* refers to the "observing self," a separate being experiencing thoughts, feelings, and behaviors but not being dominated or defined by them. *Defusion* is used to weaken the link between the verbal content and function of feelings and thoughts in order to achieve neutral perceptions of these internal events (Halliburton & Cooper, 2015). *Acceptance* is the opposite of experiential avoidance and means accepting one's private events occasioned by one's history without attempts to change their frequency or form. Finally, *contact with the present moment* refers to mindfulness, that is, being mindfully and non-judgmentally aware of whatever is happening in the moment (Hayes et al., 2006).

ACT has been successfully used in the treatment of numerous health conditions, for example, obesity (Lillis & Kendra, 2014), chronic pain (Hughes et al., 2017; Wicksell et al., 2009), epilepsy (Lundgren et al., 2006), and cardiovascular disease (Rashidi et al., 2021). It has also been used with adults with type II diabetes (Gregg et al., 2007; Sakamoto et al., 2021). In a systematic review, Sakamoto et al. (2021) concluded that ACT interventions might reduce glycated hemoglobin and increase self-care ability and acceptance among people with type 2 diabetes. Similarly, Ngan et al. (2021) concluded that mindfulness- and acceptance-based approaches may reduce distress and HbA1c. However, research involving T1D remains scarce. Bendig et al. (2021) included adults with both type 1 and type 2 diabetes in their study. They used a mobile-based ACT intervention and reported a decrease in diabetes distress levels.

Furthermore, a growing number of studies are utilizing ACT with children and adolescents (Halliburton & Cooper, 2015; Wicksell et al., 2009). ACT approaches for adolescents have shown positive effects on quality of life, psychological symptoms, and psychological flexibility (Swain et al., 2015). Greco and Hayes (2008) investigated a sample of over 1300 children and adolescents and found that psychological inflexibility was linked to maladaptive outcomes in adolescents, including increased levels of self-reported anxiety, somatic complaints, problem behaviors, and decreased quality of life. Ciarrochi et al. (2011)

found that psychological flexibility was associated with emotional well-being and prosocial skills in 14–16-year-old adolescents.

To date, there are only a limited number of ACT-based studies on adolescents with T1D. Moghanloo et al. (2015) found that ACT was effective in reducing depression and feelings of guilt as well as increasing well-being in 7–15-year-old diabetic children with T1D. Similarly, Moazzezi et al. (2015) found that ACT was effective in reducing perceived stress and increasing special health self-efficacy in 7–15-year-old children with T1D. Hadlandsmyth et al. (2013) proposed that problems in the treatment of adolescents with T1D could be connected to psychological inflexibility, especially experimental avoidance and defusion, and that ACT would be a useful tool for increasing psychological flexibility. Avoidance of diabetes-related thoughts (e.g., "I am different") and feelings has been shown to be associated with poorer diabetes management (Weijman et al., 2005). In our previous study, we found an association between psychological flexibility and glycemic control in adolescents with T1D: Higher levels of psychological flexibility were connected to better glycemic control and lower levels of depressive and anxiety symptoms (Alho et al., 2021). Overall, the results of previous studies suggest that adolescents who are struggling with diabetes management would benefit from training their psychological flexibility skills. Type 1 diabetes is a demanding condition and puts considerable strain on the daily lives of adolescents and their families. Consequently, it is important to find ways to help adolescents cope with their condition.

1.3. Aim of the study

Based on existing findings and the fact that there is a dearth of studies on acceptance and commitment therapy (ACT)-based studies on adolescents with diabetes, this study is one of the first to examine the impact of an ACT intervention on glycemic control. The purpose of this study was to evaluate the effectiveness of an ACT-based group intervention for adolescents with type 1 diabetes (T1D) who were struggling with diabetes management. More specifically, we were interested in whether incorporating an ACT intervention into ordinary care (TAU) at a pediatric outpatient clinic would have a positive impact on diabetes treatment (glycemic control) among a group of adolescents (the intervention group), promote their psychological flexibility and mindfulness skills, increase their quality of life, and decrease depressive and anxiety symptoms compared to another group of adolescents (the comparison group) undergoing TAU. Based on earlier research, we hypothesized that the ACT intervention would have positive effects on adolescents with poorly managed T1D.

2. Method

2.1. Procedure and participants

The current study is a randomized controlled trial of an ACT-based group intervention for adolescents with T1D (registered in www.clinicaltrials.gov, ClinicalTrials.gov identifier: NCT03825562, protocol ID 7U/2015). Ethics approval was obtained from the Central Finland Healthcare District's Ethics Committee (under registration number 7U/2015). Adolescents and their parents took part in the study on a voluntary basis and gave written informed consent to their participation in the study.

Recruitment for participation in the intervention was done during visits at the pediatric diabetes outpatient clinic in Central Finland Ćentral Hospital. Five professionals working at the clinic were instructed to give an information leaflet about the possibility to take part in the study to the parents or adolescents during their regular visit at the clinic. Interested parents were instructed to make contact with the researcher for further information. During the next phase, adolescents aged 12–16 were invited to join the study if their HbA1c levels were above 7.5%. This criterion was chosen to include only those adolescents who did not

meet the treatment goals (HbA1c under 7.5%). Blood glucose levels lower than 7.5% have been recommended, for example, by the American Diabetes Association (2021), since higher levels increase the risk of serious complications such as kidney or cardiovascular disease. Further, the exclusion criteria included adolescents with parallel psychological or psychiatric treatment. The inclusion and exclusion information (12–16 years, glycemic control above 7.5%, no parallel psychological or psychiatric treatment) was obtained by the researcher from the medical records of each adolescent prior to sending out the final invitation to participate in the study. The information was given to the adolescent or their family during the appointment at the clinic, after which they could ask questions about the study and give their consent to participate. Recruitment was conducted in phases and took place from October 2016 to November 2019. During this period, we estimated that there were approximately 120 adolescents in the clinic aged 12–16 years who did not meet the treatment goals (HbA1c under 7.5%), of which 72 (about 60%) accepted the invitation and agreed to participate.

Those willing to participate (n = 72) were randomly allocated to either of two groups (ACT+TAU or TAU) through the http://random.org tool (http://www.random.org/). The randomization was conducted prior to the baseline self-report assessments.

The intervention group ACT+TAU (ACT + treatment as usual, n = 36) participated in a group intervention, and the comparison group (TAU, n = 36) continued under treatment-as-usual conditions, which included visits to the pediatric clinic once every three months and meeting a doctor, a nurse, and other healthcare professionals at the clinic. The randomization was done in waves. The randomization started when approximately 20 interested participants fulfilling the inclusion criteria were obtained. The comparison group (TAU) received the pre-measurement package in ordinary mail during the same week as the intervention group, and the same procedure was conducted at post-

measurement. The comparison group was offered the same intervention after the post-measurements. Fig. 1 describes the flow of the study.

Table 1 describes the participants' background information. The mean age of the participants was 13 years in both groups (ACT+TAU: mean = 13.44, SD = 1.13; TAU: mean = 13.36, SD = 1.22), and there were slightly more girls than boys in both groups (ACT+TAU; n = 24; 66.7%; TAU; n = 21; 58.3%). The dropouts and those who withdrew participation (before the intervention began) did not differ significantly from the group that was included in the analyses in terms of the background variables of age, gender, duration of illness, and glycemic control (HbA1c, see Table 1). The background information on the dropouts and those who withdrew participation were taken from the medical records.

2.2. The intervention

The ACT-based group program is presented in Table 2. The intervention program was influenced by previous ACT interventions developed at the University of Jyväskylä, which showed promising effects (e. g., Kyllönen et al., 2018). However, the themes and practices were modified to suit the adolescents with T1D. The ACT intervention was composed of five 1.5-h sessions held every two weeks, totaling 7.5 h. There were between five and seven adolescents in each of the groups. The meetings took place at the hospital and were led by a psychologist with over ten years' experience in pediatric psychology, who is also trained in ACT. The psychologist was supervised during the study by an expert in ACT. To improve learning, voluntary homework was given during each session. An exercise book composed by the first and fourth authors was given to the participants (Alho & Lappalainen, 2015, 2019). In addition, the parents of the adolescent participants of the ACT+TAU intervention were invited to join the beginning of the first and last
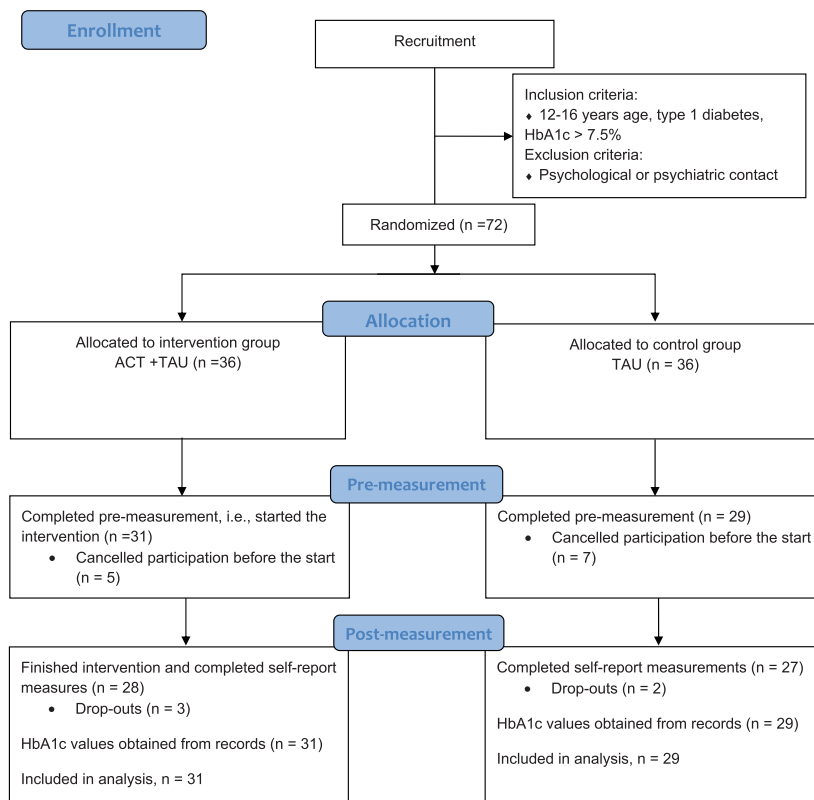

Fig. 1. Flow diagram.

Table 1

Participant characteristics. Participants who originally allocated to the treatment and control groups (n = 72), and participants who completed the pre-measurements (n = 31 + 29 = 60).

	Treatment Group ACT+TAU n = 36	Completed pre-measures n = 31	Control Group TAU n = 36	Completed pre-measures n = 29
Age				
Mean (sd)	13.44 (1.13)	13.39 (1.12)	13.36 (1.22)	13.48 (1.30)
Gender				
Female number (%)	24 (67%)	22 (71%)	21 (58%)	16 (55%)
Male number (%)	12 (33%)	9 (29%)	15 (42%)	13 (45%)
HbA1c				
Mean (sd)	8.94 (1.41)	8.92 (1.51)	9.11 (1.45)	9.15 (1.37)
CI (95%)	8.46–9.42	8.36–9.47	8.65–9.60	8.63–9.67
Min - Max	6.30–14.00	6.30–14.00	6.90–13.20	6.90–11.40
HbA1c ≤ 7.5%*	n = 7 (19%)	n = 6 (19%)	n = 7 (19%)	n = 7 (24%)
Duration of illness				
Mean (sd)	6.57 years (4.32)	6.66 (4.29)	7.13 years (4.02)	7.33 (4.02)
Min-Max	0,4 years–14 years	0.4–12.75	0.4–15.00 years	0.4–15.00

*Note. The inclusion criterion for participation was the HbA1c > 7.5%. A small number of participants showed a slight decrease in their HbA1c values between the invitation and the pre-measurement. The values in the Table present the last HbA1c measures taken before the intervention started.

sessions of the intervention in order to receive information about the intervention procedures and participate in the interviews. For parents who did not attend the sessions, data collection was administered through a telephone interview.

The adolescents and their parents in the ACT group were interviewed at the beginning and end of the intervention. The interviews were conducted by psychology students who had received training for this purpose. The interviews were semi-structured. At the beginning, five questions were posed about the adolescents' current situation with diabetes and the expectations of the group. At the end, 15 questions were addressed to the adolescents and 13 to their parents, which sought information about the experiences of the group. This paper reports only on part of the interviews and focuses on experienced satisfaction with the intervention. The complete results will be published in greater detail at a later date.

2.3. Measures

2.3.1. Glycemic control

The primary outcome measure was HbA1c, which describes the level of glycemic control. HbA1c is a proxy measure of a patient's average blood glucose level over the preceding three months (American Diabetes Association, 2021). HbA1c values are measured every three months at the diabetic clinic; for this study, the values were collected from the medical records. HbA1c was not measured separately for this study; instead, we used the measurements obtained at regular visits to the pediatric clinic. The value preceding the start of the intervention (1–2 months before the intervention) was used for the pre-measurement, and the corresponding value was used for the post-measurement after three months (1–2 months following the end of the intervention). The values for the comparison group (TAU) were collected at equivalent time points. Thus, the time between the pre- and post-measurement of HbA1c was approximately three months.

Table 2

Structure and content of the ACT-based group intervention.

Session	Content of the group program	Homework
1	Getting acquainted with the group Introductory games Behavioral analysis Exercise: Current situation and previous solutions involving glycemic control Exercise: Setting personal goals Introduction to values: Find out what is important to you? What motivates you? Exercise: Values worksheet Exercise: Value cards Exercise: Path to well-being	Value-based actions To perform one action per day based on individual personal values
2	Values Discussion about the homework and taking value-based action in your life Exercise: "If you could travel 10 years into the future and look back, what would you see?" Thoughts and emotions Introduction: Breaking routines Exercise: Stepping out of the box Exercise: Experimental practice about one's own comfort zones Exercises: "I cannot do" and "Don't think about …" Mindfulness Introduction to mindfulness: Learning how to be mindful in the here and now; the importance of mindfulness in daily life and practical examples Exercise: Leaves in a stream	Value-based actions To perform one action per day based on individual personal values Step by step towards realistic goals Make small steps towards your well-being
3	Discussion about homework Introduction and exercise: Recognizing obstacles and working with them Thoughts and emotions: Discussion and exercise: Enacting distance between your thoughts and emotions Mindfulness Exercise: Mindful breathing Acceptance Discussion Metaphor: Tug-of-war with a monster	Value-based action To perform one action per day based on individual personal values Mindfulness Listening mindfully to your favorite song or taking a walk mindfully
4	Discussion about homework Self as a context Introduction: Taking an observer's perspective towards one's own thoughts and feelings Metaphors: "House," "Sky and weather" Exercise: Strength cards Acceptance Discussion Metaphor: "Uninvited quest"	Value-based action To perform one action per day based on individual personal values Making a plan: Who could help me achieve my personal goal
5	Review of themes: Discussion Exercise: Value cards Exercise: Path to well-being Exercise: Making a future plan	

2.4. Self-report measures

All the participants were assessed at two points. In both the ACT+TAU intervention groups, the pre-measurements took place at the beginning of the intervention and the post-measurements after the last intervention session, that is, eight weeks after the pre-measurement. The comparison groups filled in the measurements concurrently: Self-report measures were sent to them by regular mail and were returned in prepaid return envelopes. Also, the parents filled in the measures concerning their adolescent children's quality of life at the time.

2.5. Psychological flexibility and acceptance and mindfulness processes

The DAAS questionnaire (the Diabetes Acceptance and Action Scale for Children and Adolescents; Greco & Hart, 2005) was developed to measure the psychological flexibility of adolescents with T1D and has been used to measure diabetes-related acceptance skills, more specifically, acceptance, experimental avoidance, and cognitive fusion. The questionnaire consists of 42 questions, and responses are given on a Likert scale from 0 to 4 (never true to always true). Example questions include "I do things that are important to me even though I have diabetes" and "It's OK to feel sad or afraid about having diabetes." The maximum score is 168, with a higher value indicating higher level of diabetes-related acceptance and action (Greco & Hayes, 2008). The Finnish version was translated from English with permission from Laurie Greco. Cronbach's alpha was α = 0.88 for both the pre-measurement and post-measurement.

The CAMM questionnaire (the Child and Adolescent Mindfulness Measure) was developed to measure acceptance and mindfulness skills. It assesses the degree to which children and adolescents act with awareness, observe internal experiences, and accept internal experiences without judging them (Greco et al., 2011). The 10-question version of the questionnaire was used, consisting of questions such as "I keep myself busy, so I don't notice my thoughts and feelings" and "I get upset with myself for having certain thoughts." The answers are given on a Likert scale from 0 to 4 (never true to always true), with higher scores indicating higher levels of mindfulness and acceptance. Cronbach's alpha for the pre-measurement was α = 0.83 and α = 0.88 for the post-measurement.

2.6. Quality of life

To measure the quality of life of the adolescents, the Revised Children's Quality of Life Questionnaire (KINDL[R], Ravens-Sieberer & Bullinger, 1998) was used. The KINDL[R] is a generic instrument for assessing health-related quality of life in children and adolescents aged 3–17 years. In this study, we used the generic youth-specific mode of the questionnaire, which consists of 24 questions, and the diabetes-specific module, which consists of 17 questions. The generic mode includes the following areas: physical well-being (e.g., "I felt ill"), emotional well-being (e.g., "I had fun and laughed a lot"), self-esteem (e.g., "I was proud of myself"), family (e.g., "I got on well with my parents"), social contacts (e.g., "I did things together with my friends"), and school (e.g., "I found school interesting"). The disease-specific questions included as follows: "I worried about my blood glucose levels being too high" and "I felt uncomfortable to measure my blood sugar level in the classroom." The parents of the adolescents filled in the quality of life questionnaire concerning their child's quality of life (KINDL-r). The parents' questionnaire also consisted of the generic module (24 questions) and the disease-specific module (six questions). The answers were given on a Likert scale of 1–5. The six subscales were combined to form a total score of a maximum of 120, with higher scores indicating better quality of life. For the analysis, the scores were scaled from 0 to 100 points. Cronbach's alpha was α = 0.91 for both the pre-measurement and post-measurement.

2.7. Symptoms of depression and anxiety

To measure symptoms of depression and anxiety, we used the RBDI (Revised Beck Depression Inventory) questionnaire, a Finnish version of the Beck Depression Inventory (Beck & Beck, 1972) that has been modified to suit adolescents. In the modified version, items measuring self-confidence were added for the purpose of counteracting the negative impacts of the items on those adolescents who had not experienced depression (e.g., the item "I don't feel disappointed in myself" in the original version was preceded by the item "I am satisfied with myself and what I have accomplished"). Also, one item measuring anxiety was

added since anxiety is often a comorbid symptom of depression. This version has generally been used in Finland over a period of 30 years and in over 50 studies. The RDBI consists of 13 questions measuring depressive symptoms and one question measuring self-reported symptoms of anxiety. The questionnaire can be used to estimate the severity of depressive symptoms and anxiety (Raitasalo, 2007). For each question (e.g., "Do you feel disappointed?" or "How do you see your future?"), there are five possible answers to choose from, and scores are given from 0 to 3. Scoring is recorded as follows: 1–2 = 0 points; 3 = 1 point; 4 = 2 points; 5 = 3 points. The maximum score for measuring symptoms of depression is 39. Scores under 5 indicate no depressive symptoms; scores between 5 and 7 indicate mild depressive symptoms; scores between 8 and 15 indicate moderate depressive symptoms; and scores above 16 indicate severe depressive symptoms. To measure anxiety ("Do you feel anxious or tense?"), there are five possible answers to choose from, and scores are given from 0 to 3. The score indicates possible anxiety and its severity (e.g., the item "I do not feel anxiety very easily/I am not anxious" scores as 0; "I feel anxious and tense pretty easily" scores as 1; I become very easily anxious and tense" scores as 2; "I feel anxiety all the time" scores as 3″). In the current study, Cronbach's alpha for the 13 questions on depressive symptoms was α = 0.86 for both the pre-measurement and post-measurement, and Cronbach's alpha for the 14 questions (including the anxiety item) was α = 0.87 for both the pre-measurement and post-measurement. The adolescent-tailored RBDI is considered a reliable measure for detecting symptoms of depression among adolescents and shows, for example, a high correlation with the original BDI. The anxiety item has been shown to correlate with depression symptoms and recommended as a measure of comorbid anxiety (Kaltiala-Heino et al., 1998).

2.8. Satisfaction with the treatment

Regarding the measurement of treatment satisfaction, the participants in the intervention group (both the adolescents and their parents) were interviewed by psychology students at the end of the final session about their intervention-related experiences. Satisfaction with the intervention was measured on a scale from 1 to 6 (1 = very satisfied, 2 = satisfied, 3 = somewhat satisfied, 4 = somewhat unsatisfied, 5 = unsatisfied, and 6 = very unsatisfied). Participants were also asked whether they would be willing to recommend the group to other adolescents with T1D (yes or no) or to other families (yes or no).

2.9. Analysis procedure

Statistical analyses were conducted using Mplus (version 8.4, Muthén & Muthén, 2017) and IBM SPSS Statistics 26. The baseline differences between the groups were explored with t-tests and chi-square tests for background variables of age, gender, duration of illness and glycemic control. The group differences in change were analyzed using structural equal modelling (SEM) and latent change scores with the full information maximum likelihood (FIML) estimation method. All the available information was used in the analyses, and missing data were assumed to be missing at random. Thus, all the randomized participants who completed the pre-measurements were included in the analyses.

Effect sizes (ES) were reported using Cohen's d. The corrected between-group ES was calculated by dividing the change in the mean difference between the intervention and control groups by the pooled standard deviation of the pre-measurement. To interpret Cohen's between- and within-group d, an ES of 0.20 was considered small, 0.50 moderate, and equal to or above 0.80 large (Cohen, 1988).

Mediations were calculated using the Mplus software, with changes in diabetes-related psychological flexibility (DAAS) as the mediator of those outcome variables showing significant group differences in change (anxiety and HbA1c). The model fit was evaluated with several types of fit indexes, including the chi-square (χ^2), comparative fit index (CFI),

and standard root mean square residual (SRMR). A non-significant χ^2 (p > 0.05), a CFI $\geq$ 0.95, and a SRMR < 0.08 were considered as indicating a good fit for the data. As recommended by Mackinnon (2008), the bias-corrected and accelerated bootstrap confidence intervals for the indirect effect were estimated using 1000 bootstrap samples.

3. Results

A total of 31 adolescents in the ACT group participated in the pre-measurement and 28 in post-measurement. The corresponding figures for the comparison group (ACT+TAU) were 29 and 27. However, all those participating in the pre-measurements (n = 60) were included in the analyses. There were no statistically significant differences between the control and intervention groups at the baseline in terms of demographic characteristics (age, gender, duration of illness, glycemic control) and the various outcome measurements. Furthermore, the dropouts did not differ in the background variables (age, gender, duration of illness, level of HbA1c) compared to the group that completed the study (Table 1).

3.1. Effectiveness of the intervention

Table 3 shows detailed descriptions of means, standard deviations, and whether groups changed in a statistically different manner from the pre-to post-measurement. At the post-measurement, we observed a significantly different change in the ACT+TAU group compared to the control condition (TAU alone) —in favor for the ACT-group— in glycemic control (between-group $d = 0.59$), diabetes-related psychological flexibility (between-group $d = 0.29$), and anxiety symptoms (between-group $d = 0.48$). Thus, the between-group ESs were moderate or close to moderate for glycemic control and symptoms of anxiety and small for

diabetes-related psychological flexibility. Following the intervention, 29% (n = 9/31) of the adolescents had an HbA1c level of 7.5% or under in the ACT+TAU group, whereas the corresponding figure for the TAU group was 17% (n = 5/29). The corresponding figures at the pre-measurement were 19% (n = 6/31) and 24% (n = 7/29), respectively. Thus, the number of participants above the recommended level of HbA1c had decreased by 10% in the ACT+TAU group, whereas the number had increased by seven percent in the TAU group. The min–max values of HbA1c at the pre- and post-measurements showed a similar positive tendency in favor for the ACT+TAU group: ACT+TAU; pre, 6.30–14.00, post, 6.40–10.60; TAU: pre, 6.90–11.40, post, 6.40–14.00. There was no significant effect in the pre-to post-measurement change in symptoms of depression, acceptance and mindfulness skills as measured by CAMM, adolescent-reported quality of life, or parental evaluation of adolescents' quality of life.

3.2. Mediation analysis

Mediation analysis was used to determine whether changes in DAAS mediated changes in glycemic control and anxiety. Thus, we wanted to explore the role of DAAS in variables that were significantly impacted by the intervention. The mediations were not significant (Table 4, indirect 95% confidence intervals were not significant), suggesting that the changes observed in DAAS did not mediate the effect of the intervention on glycemic control and anxiety.

3.3. Adherence and satisfaction with the program

Only three of the adolescents who started in the intervention groups (n = 31) dropped out during the intervention, leaving a total of 28 (90%) of those who started the intervention and completed it. Most of them

Table 3

Estimated Sample Statistics: Mean scores (M), Standard Deviations (SD), p-values for the pre-post change, and between and with-in group effect sizes.

Scale	Group	Pre M (SD)	Post M (SD)	Pre-post change between groups, Wald's test (df = 1)ₐ, (p-value)	Between group d [b]	Within group pre-post d
HbA1c	ACT-group	8.94 (1.41)	8.46 (1.13)	W = 10.796 p = 0.001	.59	.37
	control	9.11 (1.45)	9.49 (1.88)			−.22
DAAS	ACT-group	128.03 (16.31)	132.31 (16.27)	W = 4.220 p = 0.040	.29	−.26
	control	129.00 (16.89)	128.44 (16.54)			.03
CAMM	ACT-group	29.10 (5.34)	29.43 (6.08)	W = 1.516 p = 0.218	.25	−.06
	control	29.93 (6.30)	31.71 (5.29)			−.31
RBDI depr.	ACT-group	2.55 (4.36)	2.92 (5.30)	W = 0.055 p = 0.814	.04	−.08
	control	2.69 (2.97)	2.91 (3.17)			−.07
RBDI anx.	ACT-group	0.45 (0.56)	0.32 (0.48)	W = 6.388 p = 0.012	.48	.25
	control	0.35 (0.60)	0.49 (0.63)			−.24
KINDL general	ACT-group	77.34 (9.46)	76.90 (9.44)	W = 2.601 p = 0.107	.29	.05
	control	77.82 (9.23)	74.67 (9.46)			.35
KINDL diabetes	ACT-group	77.95 (12.92)	78.95 (12.50)	W = 0.117 p = 0.733	.05	−.08
	control	77.12 (11.38)	78.68 (11.80)			−.13
Parents KINDL general	ACT-group	74.47 (8.08)	76.39 (6.52)	W = 0.825 p = 0.364	.26	−.59
	control	78.85 (6.70)	78.88 (0.591)			−.35
Parents KINDL disease	ACT-group	75.618 (16.77)	83.202 (11.67)	W = 1.168 p = 0.280	.26	−.53
	control	81.009 (11.92)	84.843 (11.07)			−.33

Note. * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$. Hba1c = glycemic control. DAAS = diabetes-related psychological flexibility skills. CAMM = general psychological flexibility skills. RBDIanx = anxiety symptoms. RBDIdep = depressive symptoms. KINDL general = general quality of life. KINDL diabetes = diabetes-related quality of life. a: Investigates whether groups change differently from Pre to Post. *P*-value for difference between the treatment and control group using estimated parameters (SEM and latent change scores, Wald's test). b: Effect sizes between intervention and control groups using corrected Cohen's d.

Table 4
Outcome of the simple mediation analysis.

DAAS (the mediator)	a estimate (p-value)	b estimate (p-value)	ć estimate (p-value)	Indirect effects a x b estimate	Indirect CI [a] lower 2.5%	Indirect CI [a]n upper 2.5%	Total effects a x b + ć estimate (p-value)
HbA1c	4.79 (0.043)	−.02 (0.240)	−0.84 (0.002)	−0.084	−0.29	0.03	−0.92 (0.001)
RBDIAnx.	−4.74 (0.043)	0.01 (0.262)	−0.28 (0.007)	0.04	−0.006	0.019	−0.24 (0.011)

Note:DAAS = Diabetes-related psychological flexibility, HbA1c = Glycemic control, RBDI anx. = symptoms of anxiety. a: the effect of independent variable on mediator. b: the effect of mediator on dependent variable. ć: the direct effect of independent variable on dependent variable. a x b: indirect effects. a x b + c': total effect. [a] Confidence intervals of the indirect effects.

(87%, n = 27) participated in all the sessions. Following the intervention, the adolescents in the ACT+TAU group were asked about their experiences in the groups. On a scale from 1 to 6 (1 = very satisfied, 2 = satisfied, 3 = somewhat satisfied, 4 = somewhat unsatisfied, 5 = unsatisfied, 6 = very unsatisfied), the mean rating of the adolescents' satisfaction with the intervention was 1.75 (SD = 0.70). Eighty-six percent (n = 24/28) of them were either very satisfied or satisfied with the intervention. Almost all of them (n = 27/28; 96%) were willing to recommend the intervention to other adolescents with T1D: Only one adolescent was unwilling to recommend the intervention to others.

In addition, the adolescents' parents were asked about their experiences of the groups. Eighty-nine percent (n = 24/27) were either very satisfied or satisfied with the intervention. With the exception of one parent, all parents (n = 26/27, 96%) were willing to recommend the group to other families. The qualitative findings regarding the experiences of the adolescents and their parents will be reported in greater detail at a later date.

4. Discussion

The results of the current study showed that adolescents aged 12–16 years with poorly managed type 1 diabetes (T1D) would benefit from incorporating a brief five-session ACT-based group intervention (ACT+TAU) to treatment as usual (TAU) for diabetes case. The ACT+TAU group showed larger benefits in glycemic control, anxiety, and DAAS, reflecting the adolescents' attitude towards diabetes, compared to employing TAU alone. After the intervention, we observed a 10% increase in the number of adolescents meeting the treatment goal (HbA1c 7.5% or under), while the TAU group showed an increase of almost 10% in the number of adolescents who did not meet the treatment goal. Interestingly, it has been reported that only 17% of adolescents meet the current glycemic target (HbA1c < 7.5%) for children (American Diabetes Association, 2021), which is consistent with our TAU group. At post-measurement, 17% of the adolescents recorded glucose levels equal to or under 7.5%. After incorporating the five-session ACT intervention to TAU, close to double (29%) of the adolescents recorded their HbA1c at the recommended level.

The results of the current study are in line with those of earlier studies; in general, psychological interventions can lead to improvements in glycemic control in adolescents (Aljawarneh, Al-Qaissi, & Ghunaim, 2020). For example, Rechenberg and Koerner (2021) found that CBT techniques could improve both psychosocial and physiological outcomes (HbA1c) in adolescents with T1D. The current study is one of the first to investigate the impact of ACT interventions in the T1D context. Our results are in line with a proposal by Hadlandsmyth et al. (2013) suggesting that ACT would be a useful tool to increase psychological flexibility in adolescents with T1D as adolescents with diabetes might fuse with aversive internal experiences and engage in avoidant behaviors that result in poor diabetes outcomes.

While the brief ACT group intervention under investigation increased DAAS, equivalent changes were not observed in acceptance and mindfulness skills (CAMM). There could be several reasons for this. The ACT group intervention was heavily focused on the psychological flexibility skills associated with diabetes management. Furthermore,

disease-specific measures such as DAAS might better capture the changes in adolescents' attitudes toward their disease. It is also possible that problem-specific instruments are more responsive than generic measures (e.g., Wiebe et al., 2003). Thus, in accordance with Berlin et al. (2020), we also found that DAAS was a useful measure in the treatment of T1D.

We found that the ACT intervention had a positive impact on anxiety symptoms but not on depressive symptoms or quality of life. Anxiety and distress specifically related to diabetes are common (Anderson, 2011) and represent barriers to optimal diabetes management (Weissberg--Benchell & Antisdel-Lomaglio, 2011); therefore, attending the group intervention may have eased this distress. In fact, the TAU group showed a tendency toward an increase in anxiety, while the ACT+TAU group reported slightly lower levels of anxiety after the intervention. However, we did not observe an intervention effect on depressive symptoms. It is important to note that the exclusion criterion in our study was frequent psychological or psychiatric treatment. Thus, adolescents with severe psychological symptoms were excluded from the study, so the level of depressive and anxiety symptoms was already low at the beginning of the intervention. It is also noteworthy that anxiety symptoms were measured only with one question ("Do you feel anxious or distressed?); therefore, the results should be interpreted with caution. Furthermore, the item did not separate general anxiety or diabetes-specific anxiety.

In our earlier study, we observed a moderate association (r = 0.39) between the level of DAAS and glycemic control (Alho et al., 2021). In the current study, we observed the change in DAAS after the ACT-based intervention. Based on these observations, we investigated whether the change in DAAS in the intervention group mediated the observed beneficial change in glycemic control. The mediation analyses suggested that the change in DAAS was not a significant mediator of the changes in glycemic control. There could be several reasons for this. First, the impact of the intervention on DAAS was small. The intervention was very brief and only included five sessions. A longer intervention might have been necessary to produce larger changes in flexibility. Second, the statistical power to detect the effect might have been too small due to the relatively small sample size (n = 60). Also, it is possible that process variables other than DAAS can explain the treatment outcome. Thus, further studies are needed to clarify the role of psychological flexibility in interventions for type 1 diabetes.

The participants in the ACT+TAU (both adolescents and their parents) group reported high satisfaction with the intervention, with only three participants dropping out during the intervention. Almost all the parents were satisfied with the intervention, and a considerable majority of them and their adolescent children were also willing to recommend the group to others. Thus, the intervention model was well accepted by both the adolescents and their parents. This positive response to the intervention is an important finding, as adolescent adherence to treatment is often challenging, making it even more important to identify engaging interventions (Cunningham et al., 2021).

As our study showed, ACT may be a promising approach to target experiential avoidance and cognitive fusion in adolescents who struggle with their diabetes management. Working with these processes and encouraging adolescents to identify their values and act accordingly may be beneficial for diabetes management. There is a need for future

studies to investigate the elements or processes influencing favorable outcomes in glycemic control. It would also be possible to adapt and use the intervention created for this study in other clinical adolescent groups, for example, with obesity or pain-related problems at pediatric outpatient clinics. From a clinical perspective, ACT groups and the techniques used here are highly suitable for adolescents with somatic health problems.

4.1. Limitations

One limitation of this study was the small sample size, which limits the generalizability of the results. The participants were recruited over a period of three years from a hospital in Central Finland, which has a limited population of adolescents with T1D. The recruitment process took a considerable amount of time, even for this small sample. Furthermore, the findings were specific to adolescents and families who were motivated to participate in an intervention study. The measures of DAAS, acceptance and mindfulness skills, depressive symptoms, and quality of life were based on self-report questionnaires, and the results reflected responses to specific questions in these measures.

Furthermore, it is not possible to separate the impact of peer support from other group effects of the impact of ACT methods in the results. In the intervention group, the knowledge of being in a treatment condition and being studied could have had an impact on the results. Also, the TAU group included several elements, and we could not determine whether there was individual variation in the amount and type of treatment provided to the TAU group.

Another important point is that the HbA1c measures were not collected separately for this study as it would have involved more blood tests for the adolescents. Instead, we used the HbA1c values collected during appointments at the pediatric diabetes clinic, and the post-measurement level was one to two months following the end of the intervention. Thus, this procedure resulted in some variation when the pre- and post-measures of the HbA1c values were taken. Also, it would be important to collect and study the HbA1c levels at follow-up to determine whether the effects of the intervention persisted.

5. Conclusion

As pediatric diabetes is prevalent and often difficult to manage (American Diabetes Association, 2021), it is of outmost importance to develop interventions that may facilitate improved diabetes management. Our study is the first to examine the impact of an ACT-based intervention on glycemic control. Based on our findings, the acceptance-, mindfulness-, and value-based model seems to be suitable for adolescents with T1D who have difficulty controlling their diabetes. Therefore, we suggest that incorporating an ACT-based intervention into TAU diabetes care for adolescents could increase their treatment compliance and help them live a fulfilling life according to their values.

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III

ACCEPTABILITY OF ACT GROUP INTERVENTION FOR ADOLESCENTS WITH TYPE 1 DIABETES

by

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Acceptability of ACT group intervention for adolescents with type 1 diabetes

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A B S T R A C T

Background: Type 1 diabetes (T1D) is a demanding condition for both adolescents and their parents. The first aim of this study was to investigate the acceptability of an acceptance and commitment therapy (ACT) group intervention for 12–16-year-old adolescents with T1D. The second aim was to investigate how adolescents whose glycemic control improved during the intervention differed from those who did not improve.
Methods: A total of 28 adolescents and their parents who completed the intervention were interviewed at the end of the intervention. The adolescents filled in questionnaires regarding diabetes-related psychological flexibility (DAAS) and acceptance and mindfulness (CAMM) before and after the intervention. Glycosylated hemoglobin (HbA1c) levels were obtained from the medical records before and after the intervention. The experiences of the intervention were investigated using semi-structured questionnaires and a thematic analysis. Statistical analyses were performed to study the group differences between adolescents who improved in glycemic control and those who showed no improvement.
Results: Of those who completed the intervention, 86% of the adolescents and 89% of the parents reported being very satisfied or satisfied with the intervention. The thematic analysis showed that among the themes arising from the experiences of adolescents were increased motivation for the treatment of diabetes and a better attitude toward diabetes. Among the parents, themes such as positive changes in mood, a better attitude toward diabetes, and increased motivation for treatment emerged. In terms of group differences, those who improved with regard to glycemic control were older, their HbA1c was higher at the start, and they reported greater changes in diabetes-related psychological flexibility.
Conclusions: The ACT-based group intervention was well accepted and complemented the usual treatment. Thus, this intervention is recommended, especially for adolescents who have not met the glycemic targets.

1. Introduction

1.1. Type 1 diabetes in adolescence

Type 1 diabetes (T1D) is one of the most behaviorally and emotionally challenging chronic illnesses (Compas et al., 2012; Jonker et al., 2018) and requires frequent care. Daily management involves checking blood glucose several times a day, administering multiple insulin injections or using an insulin pump, and paying careful attention to nutrition and physical activity as well as regular appointments at diabetes clinics. In adolescence, metabolic control tends to deteriorate, with only 17% of adolescents meeting the treatment target of HbA1c of <7.0% (53 mmol/mol) for children (American Diabetes Association,

2021). This deterioration is partly due to physiological changes and partly to psychological factors such as a lack of problem-solving skills, adolescent rebellion, and the desire to belong to peer groups without seeming different (Anderson, 2003; Insabella et al., 2007). Inefficient management of diabetes has been linked to an increased risk of microvascular complications and psychological symptoms (Jonker et al., 2018). The American Diabetes Association guidelines (2022) mention the need for interventions to help adolescents with diabetes adapt to their self-management responsibilities.

Parents play an important role in treatment adherence through their direct involvement in the management of diabetes as well as through parenting style in general (Goethals et al., 2017). In adolescence, the parent's role changes from direct involvement and monitoring to acting

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as backup support (Goethals et al., 2017; Hilliard et al., 2014). This shift toward self-care is a major developmental challenge in adolescent diabetes care (Markowitz et al., 2015) and can be demanding (Wiebe et al., 2014). There can be disagreements over independence and responsibilities between parents and adolescents, and parents can experience many worries, including conflicts with their teens about T1D self-management and concerns about their teens' safety (Hessler, Fisher, Polonsky, & Johnson, 2016; Streisand et al., 2005).

Because parents of children with T1D are deeply involved with their children's care, they can risk becoming overprotective and controlling (Jubber et al., 2013), and becoming independent can therefore be a challenge for adolescents. However, the effect of having a child with diabetes on the psychological health of parents is not only negative. Parents also cite positive aspects, for example, increased family closeness, improved family health habits, and improvements in the child's psychosocial profile (Helgeson et al., 2012; Mellin et al., 2004).

1.2. Interventions for T1D

Motivation, behavioral factors, and family interaction are known to be essential in the treatment of T1D and various psychological interventions for adolescents have been studied, for instance, coping skills training, family intervention techniques, motivational interviewing, cognitive behavioral therapy, psychoeducation, and multisystem therapy. These programs have shown that psychological interventions can improve glycemic levels (Aljawarneh et al., 2020) and be beneficial to well-being, psychological adjustment, quality of life, and self-efficacy (Resurrección et al., 2021). In general, psychological interventions for adolescents with chronic conditions have been shown to be effective when aimed at reducing psychosocial problems (Snead et al., 2004).

In recent years, acceptance and commitment therapy (ACT) has gained popularity, and it is now a broadly accepted evidence-based therapy. ACT is a behavior analytically derived intervention approach that belongs to the group of third-wave behavioral or cognitive behavioral therapies that constitute a recent generation of functional contextual psychotherapy approaches (Hayes et al., 1999, 2006). The main purpose of ACT is to promote psychological flexibility (Hayes et al., 2006), a concept referring to an individual's ability to accept their own difficult thoughts and feelings while also striving to live a meaningful life according to their personal values (Hayes et al., 2013).

ACT has been successfully used in the treatment of numerous chronic health conditions, including type II diabetes (T2D) (Gregg et al., 2007), obesity (Lillis & Kendra, 2014), chronic pain (Hughes et al., 2017; Wicksell et al., 2009), and cardiovascular diseases (Rashidi et al., 2021). Studies conducted among adult populations have shown promising results in diabetes management. For instance, ACT interventions have been found to reduce glycated hemoglobin values and distress and increase self-care among individuals with T2D (Bendig et al., 2021; Gregg et al., 2007; Sakamoto et al., 2021).

ACT has also been used in children and adolescents, and positive findings have been reported (Halliburton & Cooper, 2015; Swain et al., 2015; Wicksell et al., 2009). Also, ACT-based group interventions have been used with children and adolescents (see Fang & Ding, 2020; Livheim et al., 2015; Takahashi, Ishizu, Matsubara, Ohtsuki, & Shimoda, 2020). However, studies exploring the effectiveness of ACT in children and adolescents with T1D are limited. Moazzezi et al. (2015) found that ACT was effective in reducing stress and increasing health self-efficacy in 7–15-year-old children with T1D. The results of a study by Moghanloo et al. (2015) suggested that ACT was effective in reducing depression and feelings of guilt and increasing well-being in 7–15-year-olds with T1D. Our previous study (Alho et al., 2022) was one of the first to examine the use of ACT in adolescents with T1D and showed promising findings. We found that an ACT-based group intervention offered in addition to treatment as usual had a positive effect on HbA1c values, anxiety, and diabetes-related psychological flexibility.

However, to the best of our knowledge, no studies have examined how adolescents experience an ACT-based group diabetes intervention or how parents of adolescents with T1D perceive an ACT-based intervention aimed at their children. Understanding adolescent and parental perceptions may provide clinicians with a clearer understanding of the experiences of these groups and enable them to develop better interventions for the management of T1D. Besides its effectiveness, treatment acceptability is one of the key issues to consider when developing evidence-based interventions. Acceptability has been defined as the extent to which the users of a treatment view it as reasonable, justified, fair, and palatable (Kazdin, 2000). In the current study, our aim was to explore the following dimensions of acceptability of the ACT-based group intervention: adolescents' adherence to/engagement in the intervention and adolescents' and parents' satisfaction with, and experiences of, the intervention. Further, we were interested in studying those adolescents and their parents who improved due to the intervention in comparison with those who showed no improvement. The improved and non-improved groups were defined according to the changes in their HbA1c levels.

2. Method

2.1. Procedure and participants

The current study was part of a randomized controlled trial (RCT) of an ACT-based group intervention for adolescents with T1D (registered at www.clinicaltrials.gov, ClinicalTrials.gov identifierNCT03825562, protocol ID7U/2015). Ethical approval was obtained from Central Finland Healthcare District's Ethics Committee (registration number 7U2015). Adolescents and their parents took part in the study voluntarily and gave written informed consent for their participation.

The recruitment procedure was described in detail in our earlier studies (Alho et al., 2021, 2022). Adolescents aged 12–16 who were patients at the pediatric outpatient clinic in Central Finland Central Hospital were invited to join the study if their HbA1c levels were above 7.5%, a level set to include those adolescents who did not meet the diabetes treatment targets. The exclusion criterion was receiving any parallel psychological or psychiatric treatment (independent of number of contacts/visits), as ongoing treatment could have interfered with the conclusions derived from the investigated intervention. This information was obtained by the researcher from the medical records of each adolescent before the final invitation to participate in the study was sent out. Participants were recruited during visits to the clinic, and all the adolescents within the target group were invited to participate. The recruitment was conducted in phases and took place from October 2016 to November 2019. During this period, we estimated that approximately 120 adolescents in the clinic aged 12–16 did not meet the treatment targets (HbA1c under 7.5%) of whom 72 (60%) were not having ongoing psychological or psychiatric treatment and agreed to participate.

The adolescents willing to participate in the study (n = 72) were randomly allocated to two groups (ACT + TAU or TAU). The intervention group ACT + TAU (ACT + treatment as usual, n = 36) participated in a group intervention, while the comparison group (TAU, n = 36)—not part of this study—continued under treatment-as-usual conditions. Five participants (14%) canceled before the groups started, and their premeasurements were collected. The time between pre- and postmeasurements was 10 weeks. This paper focuses on the group that completed the intervention (n = 28; three dropped out during the intervention), that is, 78% of the original sample, who were randomized to the intervention group. This group was further divided into two subgroups based on the improvement in HbA1c during the intervention (improved: HbA1c decreased pre- to post-measurement; not improved: no change or increase in HbA1c from pre- to post-measurement). Fig. 1 illustrates the flow of participants, while Table 1 provides the background information on the participants.
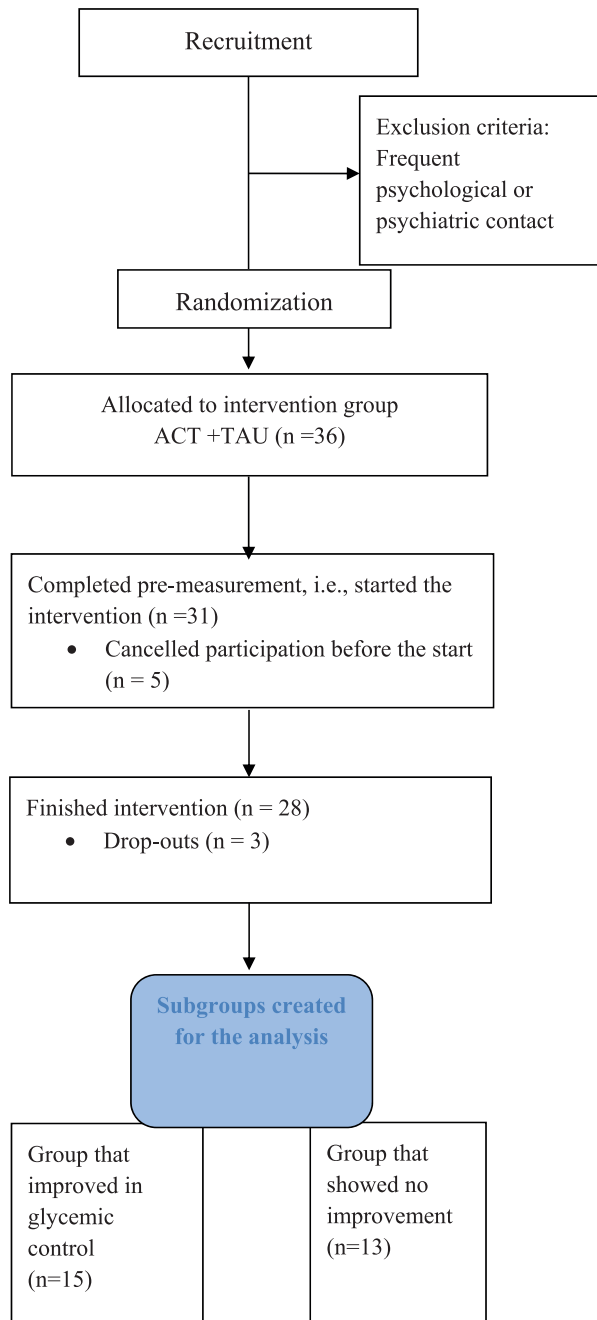
Fig. 1. Flow diagram.

Table 1

The background information of the adolescents (means and standard deviations).

	Adolescents who finished the intervention	Two groups created for the analysis	
		Improved in glycemic control	Showed no improvement
Number of adolescents	n = 28	n = 15	n = 13
Males	n = 8 (29%)	n = 3 (20%)	n = 5 (38%)
Females	n = 20 (71%)	n = 12 (80%)	n = 8 (62%)
Mean age (sd)	13.41 (1.12)	13.81 (1.17)	12.92 (.86)
12–13 years	n = 15	n = 6	n = 9
14–16 years	n = 13	n = 9	n = 4
Illness duration mean (sd)	6.66 (4.42)	7.14 (4.39)	6.07 (4.57)
HbA1c **mean (sd)**	8.95% (1.55)	9.56% (1.53)	8.18% (1.23)
CI (95%)	8.36–9.53	8.75–10.38	7.44–8.93
Min-Max [a]	6.30–14.00	7.80–14.00	6.30–10.00

[a] Note. The inclusion criterion for participation was the HbA1c > 7.5%. A small number of participants showed a slight decrease in their HbA1c values between the invitation and the pre-measurement. The values in the Table present the last HbA1c measures taken before the intervention started.

with diabetes management, clarification of values and value-based actions, mindfulness exercises, learning to handle thoughts and emotions as obstacles, and acceptance exercises. There were between five and seven adolescents in each of the groups, and an exercise book developed by the first and third authors was given to each participant (Alho & Lappalainen, 2015, 2019). Voluntary homework was given to improve learning. In addition, the parents of the adolescents were invited to join the beginning of the first and last sessions to receive information about the intervention and participate in interviews. Data of parents (n = 3) who did not attend the sessions were collected through telephone calls.

2.3. Measures

2.3.1. Attendance

Adolescents' attendance at the intervention was measured by the drop-out rate and attendance at sessions.

2.3.2. Adolescents' satisfaction with and experiences of the intervention

All adolescents in both subgroups (n = 28) participated in the individual semi-structured interviews at the end of the last session. The interviews lasted from 15 to 30 min and were conducted by psychology students trained for this purpose. The interviews were targeted at collecting feedback on the intervention and consisted of six questions related to satisfaction, perceived benefits of the intervention, acquired skills, length, and whether they would recommend the intervention.

General satisfaction with the intervention (1. *How satisfied are you with the diabetes group?*) was measured on a scale of 1–6 (1 = very satisfied, 2 = satisfied, 3 = somewhat satisfied, 4 = somewhat unsatisfied, 5 = unsatisfied, and 6 = very unsatisfied). On this scale, lower numbers indicate greater satisfaction. Adolescents were asked to assess their satisfaction with the length of the group intervention on a scale of 1–5 (2. *In my opinion, the group intervention was* 1 = too short, 2 = slightly too short, 3 = appropriate, 4 = slightly too long, and 5 = too long). Further, they were asked to reply "yes" or "no" to whether they had benefitted from the intervention (3. *Has the intervention had a positive impact on the treatment of diabetes or, more generally, on your life?*). With an open-ended question (4. *Describe the perceived benefits and your experiences of the group)*, the adolescents were asked to describe their experiences of the intervention and the perceived benefits. The replies to this question were examined using thematic analysis. Adolescents were also asked to report the kind of skills they had acquired (5. *What skills have you learned in the group?*) and indicate "yes" or "no" in relation to one or more skills from ten alternatives (Fig. 2). In terms of

2.2. The intervention

The group program is presented in Table 2, while a description of the intervention can be found in an earlier paper (Alho et al., 2022). The group (ACT + TAU) meetings took place at the hospital and were led by a psychologist trained in ACT and with over 10 years of experience in pediatric psychology. The meetings were supervised by a psychologist and supervisor with more than 20 years of experience in ACT. The ACT intervention was composed of five 1.5-h sessions held every two weeks. The themes in the sessions included individual analysis of the situation

Table 2
Structure and content of the ACT-based group intervention[a].

Session	Content of the group program	Homework
1	Getting acquainted with the group Introductory games Behavioral analysis Exercise: Current situation and previous solutions involving glycemic control Exercise: Setting personal goals Introduction to values: Find out what is important to you? What motivates you? Exercise: Values worksheet Exercise: Value cards Exercise: Path to well-being	Value-based actions To perform one action per day based on individual personal values
2	Values Discussion about the homework and taking value-based action in your life Exercise: "If you could travel 10 years into the future and look back, what would you see?" Thoughts and emotions Introduction: Breaking routines Exercise: Stepping out of the box Exercise: Experimental practice about one's own comfort zones Exercises: "I cannot do" and "Don't think about …" Mindfulness Introduction to mindfulness: Learning how to be mindful in the here and now; the importance of mindfulness in daily life and practical examples Exercise: Leaves in a stream	Value-based actions To perform one action per day based on individual personal values Step by step towards realistic goals Make small steps towards your well-being
3	Discussion about homework Introduction and exercise: Recognizing obstacles and working with them Thoughts and emotions: Discussion and exercise: Enacting distance between your thoughts and emotions Mindfulness Exercise: Mindful breathing Acceptance Discussion Metaphor: Tug-of-war with a monster	Value-based action To perform one action per day based on individual personal values Mindfulness Listening mindfully to your favorite song or taking a walk mindfully
4	Discussion about homework Self as a context Introduction: Taking an observer's perspective towards one's own thoughts and feelings Metaphors: "House," "Sky and weather" Exercise: Strength cards Acceptance Discussion Metaphor: "Uninvited quest"	Value-based action To perform one action per day based on individual personal values Making a plan: Who could help me achieve my personal goal
5	Review of themes: Discussion Exercise: Value cards Exercise: Path to well-being Exercise: Making a future plan	

[a] Intervention has been presented earlier in our previous study (Alho et al., 2022).

recommendations, adolescents were asked to reply "yes" or "no" to whether they would be willing to recommend the group to other adolescents with T1D (6. *Would you recommend the group to other adolescents?*).

2.3.3. Parents' satisfaction with and experiences of the intervention

As with the adolescents, semi-structured interviews were conducted with the parents at the end of the intervention. Eight questions were related to satisfaction with the treatment, satisfaction with the length of the intervention, perceived benefits, and willingness to recommend the intervention.

Parents' general satisfaction (1. *How satisfied are you with the diabetes group?*) was similarly measured on a scale of 1–6. Moreover, parents were similarly asked to assess the length of the intervention on a scale of 1–5 (2. *In my opinion, the group intervention was* 1 = too short, 2 = slightly too short, 3 = appropriate, 4 = slightly too long, and 5 = too long). Further, parents were asked to reply "yes" or "no" to whether they perceived that their children had benefitted from the intervention regarding the management of diabetes (3. *Has the intervention had a positive impact on your child's treatment of diabetes?*) or more generally (4. *Has the intervention had a positive impact on the child in general?*). They were also asked to answer "yes" or "no" to whether the intervention had any impact on the parents' own or the family's well-being (4. *Has the intervention had a positive impact on your own well-being?* 5. *Has the intervention had a positive impact on your family's well-being?*). With an open-ended question (6. *Describe your thoughts about the intervention and its benefits*), the parents were asked to describe their experiences related to these topics, and their responses were explored using thematic analysis. Parents were asked to reply "yes" or "no" to whether they would be willing to recommend the group to others (8. *Would you recommend the group to other adolescents?*).

2.3.4. Measurements of those who improved and those who showed no improvement

The HbA1c values of the adolescents were collected from the medical records. HbA1c is a proxy measure of a patient's average blood glucose level over the preceding 3 months (American Diabetes Association, 2021). HbA1c values are measured approximately every 3–4 months at the diabetic clinic. The value preceding the start of the intervention (1–2 months before the intervention) was used for the pre-measurement, and the equivalent value was used for the post-measurement after 3–4 months (1–2 months following the end of the intervention). The intervention group was divided into two subgroups according to improvements in the adolescents' HbA1c levels. Participants whose Hba1c levels were lower at the post- than the pre-measurement were designated "improved," while those whose Hba1c levels were equal to or higher than the pre values were designated "not improved." We then examined how these two groups differed in terms of how the adolescents and their parents had rated their experiences.

2.4. Self-report measures

2.4.1. Acceptance and mindfulness skills and diabetes-related psychological flexibility

The Diabetes Acceptance and Action Scale for Children and Adolescents (DAAS) was developed to measure the psychological flexibility of adolescents with T1D and has been used to measure diabetes-related acceptance skills, more specifically, acceptance, experimental avoidance, and cognitive fusion. It consists of 42 questions, and responses are given on a Likert scale from 0 to 4. The maximum score is 168, with a higher value indicating higher levels of acceptance and action (Greco & Hayes, 2008). The Finnish version was translated from English with the permission of Laurie Greco. The Cronbach's alpha was $\alpha = 0.90$ for the pre-measurement and 0.88 for the post-measurement.

The Child and Adolescent Mindfulness Measure (CAMM; Greco et al., 2011) was developed to measure acceptance and mindfulness skills. It assesses the degree to which children and adolescents act with awareness and observe internal experiences and how they accept internal experiences without judging them (Greco et al., 2011). The 10-question version was used. Higher scores indicate higher levels of mindfulness and acceptance. The Cronbach's alpha for the pre-measurement and post-measurement were $\alpha = 0.82$ and $\alpha = 0.91$, respectively.
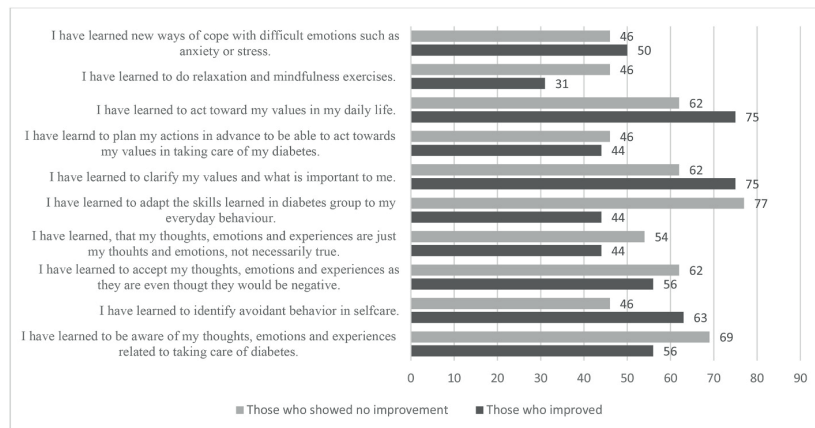
Fig. 2. Skills acquired in terms of percentages for those who improved in glycaemic control (n = 15) and those who showed no improvement (n = 13).

2.5. Methods for analysis of the total sample

The data were reported in frequencies and mean values (standard deviations, 95% confidence intervals, and min–max values), and a thematic analysis using an inductive (data-driven) approach was used. Thematic analysis is a method of identifying, analyzing, and reporting patterns or themes within data. Braun and Clarke (2006) summarized six stages of thematic analysis: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the report. This method was selected to allow for exploration of the participants' own experiences of attending the ACT groups and to deepen the earlier quantitative results.

The interviews were recorded manually, and the handwritten notes were transcribed to MS Word files soon after. The interviews were analyzed using the principles of thematic analysis, and codes were created. Thus, the interview data were transcribed to facilitate initial familiarization with the data and read several times for the initial identification of the themes. Units of themes were sought and identified. Data were classified under broad headings that involved clustering emergent themes. The full coding scheme was refined through discussion among researchers, and discrepancies regarding the codes, categories, and themes were resolved through discussions.

2.6. Methods for the analysis of the improved and non-improved groups

The intervention group was divided into two subgroups according to the changes in HbA1c levels, namely, improved and not improved. We examined how these two groups differed in their evaluations (quantitative data) and themes (qualitative data).

Statistical analyses were conducted using IBM SPSS Statistics 26. The baseline differences and differences in change scores between the subgroups for background variables (age, gender, duration of illness) as well as for glycemic control and the self-report measures were explored using the Mann–Whitney U test and chi-square test. Non-parametric tests were performed because some of the assumptions for the t-test were not met. To explore whether the skills acquired differed and whether the experienced benefits of the parents and adolescents differed in the two subgroups, a cross-tabulation analysis was used.

3. Results

3.1. Adolescents' adherence to the intervention

A vast majority (90%; n = 28) of the adolescents who started in the intervention group (n = 31) completed it, and only three dropped out during the intervention. Most of the adolescents (89%; n = 25) participated in all sessions; thus, the adherence rate was 90%.

3.2. Adolescents' satisfaction with the intervention

The mean rating of the general satisfaction of the adolescents with the intervention was 1.79 (SD = 0.74) on a scale of 1–6 implying a high satisfaction rate (on this scale, lower numbers indicate greater satisfaction). Among the adolescents, 86% reported being either very satisfied (39%; n = 11) or satisfied (46%; n = 13), and 14% (n = 4) were somewhat satisfied. No one indicated that they were dissatisfied. A vast majority (86%; n = 24) were satisfied with the length of the intervention. Four adolescents evaluated the intervention as a little too short.

In terms of benefits from the intervention, all adolescents (n = 28) reported that they had perceived benefits, such as increased motivation for treatment and a better attitude towards diabetes including positive effects on mood and changes in thinking.

Regarding acquired skills, around 71% (n = 20) reported having learned skills related to values and value-based actions (*Values clarification* and *Acting toward your values*). Skills related to the ability to be in the present moment (*Learning to become aware of your own thoughts and emotions*) were mentioned by 64% (n = 18) of the participants.

Finally, all except one (97%; n = 27) were willing to recommend the intervention to other adolescents with T1D. The adolescent who was not willing to recommend the intervention belonged to the improved group and gave as a reason the fact that the skills taught were already familiar to her.

3.3. Adolescents' experiences of the intervention

The thematic analysis, that is, adolescents' replies to the open-ended questions about their experiences and the perceived benefits of the intervention, yielded five themes (Table 3).

Increased motivation and self-care: A total of 15 adolescents (54%) addressed the theme of motivation for diabetes treatment. The adolescents reported that their motivation to take better care of themselves had increased. This increase in self-care included, for example, checking blood glucose or taking insulin more regularly.

Peer support *and sharing:* In total, 12 adolescents (43%) perceived that they had received peer support from participating in the intervention. They appreciated being able to share and listen to the thoughts of others with T1D.

Attitude towards diabetes: Altogether, 11 adolescents (39%) described how they had started to think about their diabetes differently; that is,

Table 3
Themes from the adolescent's interviews.

Theme	Example of theme	Number of Mentions, n (%)
Increased motivation and self-care	'Many nights I have taken more insulin, which is good, as the blood sugar has been high.' 'Motivation for treatment has increased, which has led to better health as I have been taking better care of my diabetes.' 'I have started to measure my blood sugar levels more often and started taking more responsibility for my diabetes.'	15 (54%)
Peer support and sharing	'You could see that others were going through the same stuff with diabetes; you are not alone with your problems.' 'The feeling of the others understanding what you are going through is worth experiencing.' 'Hearing from the others' experiences and talking with the other adolescents made me feel better.'	12 (43%)
Attitude towards diabetes	'I have been thinking about what diabetes means to me. Being in the group made me think why my blood sugar levels are so high.' 'I have a more positive attitude towards diabetes now. I have noticed that I'm not the only one having difficulties with it.'	11 (39%)
Changes in mood	'My mood had improved, as I have been able to talk about diabetes with people who understand what it is like.' 'Attending the group has made my mood better.'	5 (18%)
Changes in thinking	'My thinking has changed: I have been thinking more about what I could do to take better care of diabetes. I have realized that my actions have an effect on my glycaemic control.' 'I received new ways of thinking, as we have thought about own values and whether we act towards our values.'	3 (10%)

they had started to feel better about their diabetes or developed a more positive attitude toward it.

Changes in mood and in thinking: Five (18%) adolescents reported that they now experienced a better mood and were happier, more positive, and more energetic. Three adolescents (10%) perceived changes in thinking, for instance, changes in what how they thought about life in general, life values, and actions based on values.

3.4. Parents' satisfaction with the intervention

Of the parents (n = 28), 89% reported being either very satisfied (43%; n = 12) or satisfied (46%; n = 13) with the group; 7% (n = 2) were somewhat satisfied, while 4% (n = 1) were somewhat unsatisfied. Generally, nearly 90% of the parents (89%; n = 25) perceived that the group had been beneficial to their adolescents' diabetes self-management.

Regarding the length of the intervention, 61% (n = 17) of the parents were satisfied, while 43% (n = 12) estimated that it was too short or a little too short. In addition, several parents reported that they had hoped for additional sessions, as the changes in adolescent thinking and behavior might take more time. Some of the parents also hoped that this kind of intervention would be possible in the future as part of the T1D treatment.

A majority (61%; n = 17) of the parents reported that the intervention had been beneficial for their own well-being. They perceived that as their adolescents' motivation toward treatment improved, their concern for and worries about them decreased. More than half (57%; n = 16) reported that the intervention had been beneficial to the well-being of

the whole family, reporting that the atmosphere at home was better, as there were fewer arguments about diabetes between the adolescents and their parents or siblings.

Furthermore, all except for one parent (97%; n = 27) were willing to recommend the group to others. One parent who was part of the improved group was not willing to recommend the group, as the parent perceived that it disturbed the adolescent's schoolwork.

3.5. Parents' experiences of the intervention

The interviews with the parents yielded seven themes related to the experiences and benefits of the intervention (Table 4). The thematic analysis resulted in the following themes.

Changes in mood: Up to 50% of the parents (n = 14) perceived that their children were more positive or in a better mood after attending the group.

Attitude towards diabetes: A total of 12 parents (43%) described their adolescents as being better adjusted to and more positive and open about diabetes.

Increased motivation and self-care: In total, 11 parents (39%) reported that their adolescents had increased motivation and were checking blood glucose or taking insulin more regularly or, more generally, showing better self-care.

Peer support *and sharing:* Nine parents (32%) reported high peer support and a strong possibility for their children to talk about their feelings about diabetes in the group. They perceived that this was beneficial for the well-being of their adolescents.

Benefits regarding the well-being of the parents: Eight parents (29%)

Table 4
Themes from the parents' interviews.

Theme	Example of the theme	Mentions, n (%)
Changes in mood	'She/he has been more balanced and calmer.'	14 (48%)
Attitude towards diabetes	'It has been easier to talk about diabetes and the child has been more open to discuss about self-management.'	12 (41%)
Increased motivation for and self-care	'The child has checked her blood sugar more frequently. She is more aware of it and does it regularly.' 'The child has started to do "sub targets" from the instructions he has been given from the diabetes clinic, and also acts according to them. He also takes the insulin before breakfast, which he didn't want to do before.'	11 (38%)
Peer support and sharing	'The child has experienced that it's good that you don't need to explain yourself, as everybody (in the group) knows how it's like to have diabetes. This has helped with the emotions.'	9 (31%)
Benefits for the parent's well-being	'When the child feels better, you feel better as well.' 'When the child's own motivation for treatment improves, your own worry about the child gets easier.'	8 (29%)
Atmosphere at home and decreased conflict	'It is easier at home; we don't fight that much anymore.'	7 (24%)
Independence, increased sense of responsibility	'She/he has grown mentally. Glycaemic control is improving. Transfer to adults' diabetes clinic soon and she/he has realized her/his own responsibility.' 'She/he has started to think about diabetes and the future. She/he talks more about it, and is getting more independent and takes more responsibility for the treatment.'	6 (21%)
Changes in thinking	'This has changed the child's thinking about diabetes and other stuff as well. His/her thinking isn't so "black and white" anymore.'	4 (14%)

reported that when their children's self-management of diabetes improved, or when the child was more open to discussion or took more responsibility for their diabetes, the parents' worry about the children eased, and their own well-being increased.

Improved atmosphere at home and decreased family conflict: Seven parents (25%) reported that tension at home had decreased and there were fewer arguments related to diabetes and in general at home between the adolescents and their parents or with their siblings.

Independence and increased sense of responsibility: Six parents (21%) perceived that their adolescents took more responsibility for their treatment, thinking about the future, and taking steps to become independent. Parents who addressed this theme often felt relieved by this development.

Changes in thinking: Four parents (14%) reported that their adolescents had gained more perspective on their situations.

All in all, the parents did not report any adverse effects from the intervention, although one parent mentioned that the group took too much time away from school. Many of the parents hoped that this kind of group would last longer or become a permanent addition to the treatment as usual.

3.6. Differences between the improved and not-improved adolescents

In the improved group (n = 15), the mean improvement (change score) in HbA1c level from pre- to post-measurement was 1.24 (SD = 1.00, min-max change = 0.20–3.30 to positive direction), and in the group that showed no improvement (n = 13), the mean change score was −0.38 (SD = 0.37, min-max change = 0.00–1.10 to negative direction); see Table 5. A statistically significant difference between the two groups (improved: HbA1c decreased pre- to post-measurement; not improved: no change or increase in HbA1c from pre- to post-measurement) was observed in the adolescents' age (U = 57.500, p = .035) and in the level of HbA1c at the pre-measurement (U = 51.000, p = .020). In the group that improved in glycemic control at the beginning of the intervention the adolescents were older (mean 13.81 years, SD = 1.17), and their HbA1c was higher (mean 9.56, SD = 1.53) than the group that showed no improvement (age: mean 12.92 years, SD = 0.86; HbA1c: mean 8.18, SD = 1.23). The groups did not differ in the duration of diabetes or gender. Nor did the groups differ significantly in acceptance and mindfulness skills (CAMM) or diabetes-related psychological flexibility (DAAS) at the pre-measurement. However, we found a statistically significant difference in the change of diabetes-related psychological flexibility (Table 5). Diabetes-related psychological flexibility increased more in the group that improved than in the group that showed no improvement. However, the two groups did not differ in

change in acceptance and mindfulness skills.

Investigating satisfaction with the intervention revealed no statistically significant differences between the two groups in the adolescents' or their parents' evaluations. The satisfaction rate for adolescents who improved in glycemic control was *M* = 2.00 (SD = 0.73), while that for their parents was *M* = 1.88 (SD = 0.22). For adolescents who showed no improvement, the satisfaction rate was *M* = 1.54 (SD = 0.52), while for their parents, it was *M* = 1.54 (SD = 0.52). There were no differences in most of the variables between the two subgroups regarding the perceived benefits of the intervention. For the adolescents, no significant differences between the groups were detected in the reported themes. In the non-improved group, parents reported more often that they had

Table 6
The amounts and percents of mentions of themes by the adolescents and the parents.

	Number of mentions		χ^2 df = 1
	Improved in glycemic control (n = 15)	Showed no improvement (n = 13)	
Themes produced by the adolescents			
Increased motivation and self-care	8 (53%)	7 (54%)	.04 (p = .84)
Peer support and sharing	6 (40%)	6 (46%)	.22 (p = .64)
Attitude towards diabetes	5 (33%)	6 (46%)	.68 (p = .41)
Changes in mood	1 (4%)	4 (23%)	3.02 (p = .08)
Changes in thinking	3 (20%)	0 (0%)	2.72 (p = .10)
Themes produced by the parents			
Changes in mood	6 (38%)	8 (50%)	1.67 (p = .20)
Attitude towards diabetes	5 (31%)	7 (54%)	1.51 (p = .22)
Motivation for treatment of diabetes	6 (38%)	5 (38%)	.00 (p = .96)
Peer support	3 (19%)	6 (46%)	2.52 (p = .11)
Benefits for the parent's wellbeing	2 (13%)	6 (46%)	4.07 (p = .04)
Atmosphere at home and decreased conflicts	2 (13%)	5 (38%)	2.64 (p = .10)
Independence, increased sense of responsibility	4 (25%)	2 (15%)	.01 (p = .90)
Changes in thinking	3 (19%)	1 (33%)	.74 (p = .39)

Table 5
The means, standard deviations (sd), confidence intervals (CI) and change scores in the improved and no-improved groups. Statistical differences in change scores between the "improved" and "not improved" groups are also reported.

	Group that improved in glycemic control n = 15		Group that showed no improvement n = 13		Group that improved Change score mean (sd)	Group that showed no improvement Change score mean (sd)	Mann-Whitney U	p-value
	Pre	Post	Pre	Post				
HbA1c								
Mean	9.56	8.32	8.18	8.56	1.24	−.38	0.000	<.001
Sd	1.53	1.11	1.23	1.31	(1.00)	(.37)		
CI 95%	8.75–10.38	7.73–8.91	7.44–8.93	7.77–9.36				
CAMM								
Mean	29.13	29.07	29.54	30.08	−.06	.54	118.000	.54
Sd	6.40	5.55	4.82	7.33	(3.51)	(4.44)		
CI 95%	25.72–32.53	25.99–32.14	26.62–32.45	25.65–43.51				
DAAS								
Mean	128.70	134.13	126.46	130.08	5.43	3.62	59.000	.048
Sd	20.60	20.13	12.22	13.12	(6.60)	(8.19)		
CI 95%	117.72–139.66	123.40–144.85	119.07–133.85	122.15–138.00				

HbA1c = glycemic control, CAMM = acceptance and mindfulness skills, DAAS = diabetes-related psychological flexibility.

benefitted from the intervention than parents in the improved group (Table 6). The two subgroups did not differ in the skills they reported having learned. Fig. 2 shows the percentages of the skills learned.

4. Discussion

This study is part of an RCT studying the feasibility and effectiveness of an ACT-based group intervention for adolescents with T1D. As the intervention showed positive results in the adolescents' glycemic control, diabetes-related psychological flexibility, and anxiety, our aim in the current study was to explore how the adolescents and their parents perceived the ACT-based group intervention. We also investigated whether those adolescents who improved in glycemic control and those who showed no improvement differed in background variables, changes in psychological flexibility skills, and perceptions and experiences.

First, we explored how the adolescents attended the intervention and how satisfied the adolescents and their parents were with the intervention. Both the high attendance rate of 90% and the high satisfaction rates of the adolescents and their parents indicated that they were satisfied with the ACT-based group intervention. More than 85% of both adolescents and parents reported being satisfied or very satisfied with the intervention, and all except one adolescent and one parent were willing to recommend the intervention to others. Findings from other studies support our high satisfaction rate. For example, a positive psychology intervention study among adolescents with T1D (Jaser et al., 2014) reported a rate of 90% for attendance and high satisfaction with the intervention.

Second, we explored the skills and benefits that the adolescents reported having acquired from the groups, and the most reportedly acquired skills were *value clarification* and *acting toward your values*. According to Tunç et al. (2023), valued living is a critical mechanism of change to target within the ACT therapeutic model. This essential content of ACT may fit well with the exploratory nature of adolescents and their increasing capability for abstract thinking (Fang & Ding, 2020; Hadlandsmyth et al., 2013). Interestingly, those who showed no improvement in glycemic control experienced the same benefits and were equally satisfied with the interventions as the improved group.

In terms of advantages acquired from the intervention, increased motivation for the treatment of diabetes, acquired peer support and sharing, and a better attitude toward diabetes were reported most often by the adolescents. Motivation for treatment was one of the main targets of the intervention, and this finding shows that an ACT approach was well suited for this purpose. In addition, many adolescents reported attitudinal changes towards diabetes. The adolescents also appreciated peer support and sharing with others, which are known to be important in all chronic illnesses (Ahola Kohut et al., 2014). Peer support is recommended for individuals with T1D to reduce the burden of living with the condition, facilitate appropriate independence in self-management behaviors, and improve outcomes (Young-Hyman et al., 2016). For example, DeJonckheere et al. (2021) found a similar theme in their study, where the adolescents and their parents valued the experience of being around others with T1D and their families.

Regarding the benefits and experiences of the parents, many reported that they had observed positive changes in mood, increased motivation for treatment, and a better attitude toward diabetes in their children. For instance, changes in mood were reported by nearly half of the parents. A vast majority (89%) of the parents reported that the intervention had been beneficial to their children's diabetes self-management. About one in five parents (21%) had observed an increased sense of responsibility and independence in their children. This is an important theme, as adolescents need to gradually develop autonomy in disease management and health-related tasks with complete autonomy often arriving in late adolescence (Beacham & Deatrick, 2013; Tuohy et al., 2019).

While parental involvement is important, treating diabetes in adolescents may also involve conflicts between the parent and the adolescent (Tuohy et al., 2019). In our interviews, conflict and disagreements were reported by several parents. Earlier studies found that parents have difficulty allowing this age group to be independent in managing their diabetes (Wennick et al., 2009). In the current study, one advantage of the intervention, in the parents' opinion, was an easier atmosphere at home and fewer disagreements concerning diabetes.

This intervention was aimed at the adolescents only, with no specific program for the parents. However, around 60% of the parents reported that the group had benefitted their own well-being and that of their families. This is notable because it is known that parental distress among teens with T1D can have health consequences for both the parent and the child (Hessler et al., 2016). In addition, poorer metabolic control can occur if there are higher levels of diabetes-specific family conflicts (Sander et al., 2010; Scholes et al., 2013). Based on our findings, the current intervention might help us to ease parental distress and diabetes-related family conflicts even though the intervention targets only adolescents.

Overall, both adolescents and parents gave very positive feedback about the intervention. Nonetheless, we received feedback from one parent that the groups disturbed the adolescent's schoolwork. An attempt was made to take into consideration when the groups were planned: the groups were organized in the afternoon after the school day, but this could still be too early a starting time for some families. When planning groups, it is important to consider whether the timing of the groups is suitable for the participants.

Finally, we investigated the differences between those adolescents whose glycemic control levels improved and those who did not show improvement in terms of their perceptions of the experiences with the intervention. Similar advantages were perceived in both groups. Interestingly, those whose blood glucose levels remained at the same level or weakened also gave positive feedback concerning the intervention and reported having experienced benefits from attending the groups. Thus, based on the feedback from adolescents, the investigated intervention model has benefits beyond beneficial changes in improvement in glycemic control.

However, we found differences in the adolescents' ages and HbA1c levels at the beginning of the intervention between the groups indicating that the older adolescents and those whose glycemic control was weaker benefitted more from the intervention provided. This finding is in accordance with those of earlier studies. For instance, Katz et al. (2014) found that adolescents with suboptimal glycemic control benefitted more from the interventions than those who achieved the targets of the treatment. Moreover, Shapiro et al. (2021) proposed that at-risk adolescents who have lower levels of modifiable skills would benefit more from psychosocial skill-building interventions. In accordance with this, it was reported in an ACT study aiming to reduce stress symptoms that adolescents experiencing more stress at the baseline gained the most from the intervention (Puolakanaho et al., 2019).

Furthermore, diabetes-related psychological flexibility increased more in the group that improved in glycemic control. This finding suggests that improvement in glycemic control was related to increased diabetes-specific psychological flexibility skills including attitude to diabetes and diabetes-related acceptance. However, the role of diabetes-related psychological flexibility is still unclear. In our earlier studies, we found that higher diabetes-related psychological flexibility was related to better glycemic control (Alho et al., 2021). However, the change during the intervention observed in diabetes-related psychological flexibility did not mediate the effect of the intervention on HbA1c (Alho et al., 2022)(Alho et al., 2022). Thus, further studies are needed to understand the role of psychological flexibility in ACT interventions for diabetes and the processes responsible for changes in HbA1c, in particular among those showing clinically significant improvement in glycemic control.

4.1. Limitations

There are several limitations to this study, the most significant being the small sample size. The participants were recruited over 3 years from a hospital in Central Finland, a limited population of adolescents. The small sample size limits the generalizability of the results, especially as regards quantitative data. As concerns the qualitative analysis, the results must be generalized very cautiously to people not represented in this sample. The current study investigated adolescents aged 12–16 and their parents who voluntarily participated in the study. Further, it can be argued that qualitative methods are by their nature more subjective and can thus lead to opportunities for erroneous and biased conclusions (Chapman et al., 2015). In addition, since this study focused on adolescents, we do not have any background data on the parents. Moreover, the measures of diabetes-related psychological flexibility and acceptance and mindfulness skills were obtained using self-report questionnaires, and the results reflect responses to specific questions. It must also be noted that the interviews were recorded by hand and then transcribed.

HbA1c values were collected from the medical records, and the time between the two measure points was short (3–5 months). Another important point is that the HbA1c measures were not collected separately for this study as doing so would have involved more blood tests for the adolescents. Instead, we used the HbA1c values collected during appointments at the pediatric diabetes clinic, and the post-measurement level was 1–2 months following the end of the intervention. Thus, this procedure resulted in some variation when the pre- and post-measures of the HbA1c values were taken. Therefore, in the future, it is important to monitor how the effects continue to change, as changes may occur beyond the duration of the intervention. Also, it must be kept in mind that the subgroups created for the analysis (those who improved and those who showed no improvement) were based on the change in HbA1c levels. Improvement was defined as a decrease in the HbA1c levels, and a more exact threshold in the current study was a change of 0.20 in HbA1c (as a minimum decrease). Other and more strict threshold values could also have been used. Furthermore, it is not possible to separate the impact of peer support or other group effects from the impact of ACT methods.

Although few participants dropped out during the intervention (10% over three years), it is a limitation that the reasons for dropping out or canceling participation before the study started are not known. Knowing these reasons could give useful information about those participants that are difficult to reach. The background variables of those who dropped out or withdrew before the start of the intervention did not differ significantly from the group that was included in the analyses. We assume that some of those who dropped out had a problematic relationship with diabetes, and attending the intervention might have been too burdensome. Furthermore, the exclusion criteria for the study included adolescents who, according to the patient files, reported ongoing psychological/psychiatric treatment so that a parallel psychological treatment would not interfere with the results of the current intervention. However, this criterion limits the interpretation of these results, as some of those adolescents who were struggling with diabetes were not invited to participate.

5. Conclusion

Attendance at an ACT group was very positively evaluated qualitatively by the adolescents, and their parents supported the acceptability of the intervention. The adolescents who improved and those who showed no improvements in their glycemic control levels perceived the group intervention similarly. These findings suggest that an ACT-based group intervention is well-suited for adolescents with T1D and can be beneficial not only for the self-management of diabetes in adolescents but also for the well-being of the adolescents and their parents.

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Declaration of competing interest

Given their roles as Editorial Board Members Lappalainen P. and Lappalainen R., had no involvement in the peer-review of this article and had no access to information regarding its peer-review. All other authors have declared no conflicts of interest.

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