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Effects of gender, age, and diabetes duration on dietary self-care in adolescents with type 1 diabetes: A Self-Determination Theory perspective

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Abstract

This study tests a model derived from Self-Determination Theory (SDT) (Deci and Ryan, 2000) to explain the mechanisms by which non-modifiable factors influence dietary self-care in adolescents with type 1 diabetes (n = 289). SEM analyses adjusted for HbA1c levels revealed that longer diabetes duration and female gender were indicative of poorer dietary self-care. This effect was mediated by contextual and motivational factors as posited by SDT. Poorer autonomy support from practitioners was predominant in girls with longer diabetes duration. Perceived autonomous motivation and self-efficacy were indicative of greater autonomy support, and led to better dietary self-care.

Keywords

adolescents, autonomous motivation, dietary self-care, type 1 diabetes

Type 1 diabetes is characterized by persistent hyperglycaemia resulting from the body's inability to produce insulin. To control blood sugar levels, patients must manage a complex set of self-care activities, among which diet plays a central role. Specifically, the matching of insulin doses to dietary intake with respect to the carbohydrate load and the quality of foods are said to be prerequisites for diabetes prognosis (American Diabetes Association, 2007). However, most adolescents fail to follow their prescribed dietary plan (Delamater, 2000). Since the early onset of type 1 diabetes implies that non-adherent patients may face serious complications at young ages, it seems important to identify *which* adolescents are more likely to neglect their dietary plan.

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Studies have established that current age, gender, and diabetes duration are crucial non-modifiable risk factors for diabetes poor management. That is, adolescents who are older (Dashiff et al., 2006; Helgeson et al., 2009), and those whose disease duration is longer (Craig et al., 2002; La Greca, Auslander et al., 1995), are more likely to have problems with diabetes self-care. As for the effect of gender on self-care, past studies have yielded conflicting results, with many reporting poorer self-care in girls (Bryden et al., 2001; La Greca, Swales et al., 1995), whereas some report greater difficulties in boys (Naar-King et al., 2005; Perwien et al., 2000). One reason for the mixed evidence may be that male and female adolescent samples were compared without reference to age or diabetes duration. For instance, Hanna and Guthrie (1999) reported that older girls are more prone to miss snacks, eat unhealthy foods, and accordingly adjust their insulin dosage to compensate for dietary poor management than their male counterparts. Other studies have pointed out that diabetes complications are more prevalent in girls with longer diabetes duration (Huang et al., 2004; Rewers et al., 2002). Gender differences in diabetes self-care activities can therefore be misleading if they do not consider 'gender-age' and 'gender-diabetes duration' interaction effects. Nevertheless, the interaction between these factors has not been systematically addressed to date.

In addition, little is known about *why* these factors or the interactions between them are related to dietary self-care. The important point is that these effects take place during adolescence, which adds to the ongoing challenges of diabetes management that young patients tackle daily. One of these challenges is to manage parental and practitioners' expectations for care. When adolescents repeatedly fail to meet such expectations, interpersonal frustrations, tensions, and conflicts often arise, significantly compromising diabetes control. As a result, significant others may behave in such a way that adolescents feel either controlled or left alone in their self-care efforts. The concept of 'miscarried helping' explains how a social support system can backfire and undermine the motivational resources of patients with diabetes toward proper care (Anderson and Coyne, 1991).

In the light of this, could older adolescent girls be prone to mismanage their dietary self-care recommendations because they perceive less support from parents and health care practitioners? Could they experience a motivational deficit that hampers effective dietary self-care? A useful theoretical framework for understanding these questions is Self-Determination Theory (Deci and Ryan, 2000), a theory of motivation that focuses on both the contextual and motivational factors that facilitate optimal psychological growth and functioning.

Self-Determination Theory

Perceived competence and perceived autonomous motivation

It is generally considered that dietary self-care is difficult to achieve. Deci and Ryan (2000) contend that a prime ingredient in the implementation of such behaviour is the need to feel competent, a general inborn need of effectiveness which refers to the judgment of one's abilities to produce given attainments. Perceived competence is theoretically related to the self-efficacy concept which is more specific in nature as it constitutes a socially acquired expectancy to enact successfully a given action (Bandura, 1977). In the juvenile diabetes literature, perceived self-efficacy have been found to be a strong predictor of adolescents' dietary self-care (Nouwen et al., 2008). However, SDT postulates that one must not only feel effective, but also perceive themselves as autonomously motivated to self-initiate and maintain action. According to SDT, the degree to which a behaviour is chosen without control and corresponds to ones' values reflects different types of regulations (or motivation), which can be ordered along a continuum. From high to low levels of autonomy, these are *intrinsic motivation*, *extrinsic motivation*, and *amotivation*.

Acting intrinsically implies performing an activity out of choice, satisfaction, or pleasure. In contrast, extrinsic behaviours are performed as a mean to an end, and they vary in degree of relative autonomy. Before any autonomy, the behaviour is enacted through *external regulation*. It is determined by sources external to the person, such as tangible benefits or costs. A more autonomous form of extrinsic motivation is *introjected regulation*, which refers to behaviours that are performed to avoid feelings of guilt or shame, or in order to feel self-worthy. Next is regulation through *identification*, which refers to behaviours that are valued and enacted willingly. Finally, at the lowest level of autonomy is amotivation, which involves a lack of intention and motivation.

SDT makes specific predictions about the consequences of motivation. Autonomous reasons for engaging in a behaviour, as depicted by intrinsic and identified regulation, lead to more positive outcomes, whereas non-autonomous regulations, which correspond to controlled regulation (introjected and external) and amotivation, result in negative outcomes (Deciand & Ryan, 2000). Research based on SDT has consistently shown evidence that autonomous motives for action are related to the adoption of health related behaviours such as exercising and weight control (Chatzisarantis and Hagger, 2009; Mata et al., 2009; Silva et al., 2010a; 2010b), food planning (Otis and Pelletier, 2008), smoking cessation (Williams et al., 2002; Williams et al., 2009a), and medical adherence (Williams et al., 2009b). In the realm of diabetes, while no SDT studies have yet been carried out in samples of adolescents living with type 1 diabetes, studies involving adults with type 2 diabetes have shown that autonomous motivation toward dietary self-care is associated with effective care and metabolic control (Williams et al., 2004). Thus, adolescents who present high perceived autonomous motivation and self-efficacy toward dietary self-care would be expected to show better dietary self-care than those with less optimal motivational factors.

The role of significant others

In line with previous theoretical frameworks (Deci and Ryan, 2000; Vallerand, 1997), active support from significant others is needed for one to present optimal motivational factors. Studies have argued that contextual support can be either controlling or supportive. When adolescents feel pressured to comply with dietary recommendations, they feel controlled. In contrast, an autonomy-supportive environment acknowledges adolescents' perspectives, provides meaningful information and choices about treatment, and minimizes the use of pressure to adopt self-care practices. In the paediatric setting, the supportive role of health care practitioners and parents has long been recognized as important for youth self-care behaviours (De Civita and Dobkin, 2004). However, to date, little attention has been paid to the extent to which this social milieu is autonomy supportive (versus controlling).

Research in adults with diabetes indicates that those who perceive greater autonomy support from physicians also display greater feelings of effectiveness and autonomous motivation toward dietary self-care than those who feel inefficacious and pressured to comply with recommendations (Williams et al., 2005; Williams et al., 2004). More importantly, these studies indicate that patients who benefit from an autonomy-supportive physician also present better dietary self-care and control. Nonetheless, when juvenile diabetes is the issue, parental involvement is required. To date, no study has investigated youth's perceptions of parental autonomy support toward dietary self-care. However, Kyngäs and colleagues (1998) indicated that accepting and motivating parental actions are crucial to the management of diabetes. In their study, good adherence was predominantly found in patients whose parents showed a natural interest in them, accepted them as they were, and provided them with positive feedback as well as interest and help. Unfortunately, many parents get caught up with controlling the way their child eats, believing that this will translate into

better diabetes control. Parents' lack of autonomy support is therefore a potential correlate of diabetes poor management in youth.

The present study

In this study, we first sought to verify if adolescents of older age, female gender, and with longer diabetes duration are the ones who experience greater dietary self-care difficulties. In addition to evaluating these main effects, we also explored their systematic interactions on dietary self-care. By doing so, this study seeks to provide more information on the distinct and combined role of gender, age, and diabetes duration on adolescents' dietary self-care. Moreover, we tested a model based on Self-Determination Theory, depicting how contextual and motivational factors may explain the effects of previous significant non-modifiable characteristics on dietary self-care. The present study will also provide insight on the significance of non-modifiable characteristics on the motivational sequence proposed by Self-Determination Theory (Deci and Ryan, 2000). More specifically, the hypothesized model posits that: (1) non-modifiable characteristics influence perceptions of autonomy support from parents and practitioners, (2) greater autonomy support predict more optimal motivational factors toward dietary self-care (i.e. high autonomous motivation and self-efficacy), and (3) optimal motivational factors predict better dietary self-care. Hypothesized relations among variables where estimated while controlling for adolescents' metabolic control.

Method

Participants

Participants were recruited from outpatient lists of two major paediatric diabetes centres. Eligibility criteria included having type 1 diabetes and being aged between 11 and 17 years. In total, 289 adolescents agreed to participate to the study (133 girls, 46%), with a mean age of 14 years (SD = 1.5). Average age at diabetes diagnosis was 8.2 years (SD = 3.7), and average diabetes duration was 5.6 years (SD = 3.8). Mean HbA1c value was 8.5 percent (SD = 1.6%).

Procedure

Participants were recruited following approval from appropriate institutional review boards. Families were either informed about the study by telephone prior to the child's next outpatient appointment, or approached by their treating physician. Parental consent was obtained for all interested adolescents and adolescents were invited to give their assent to participate. Adolescents completed a self-report questionnaire booklet at the diabetes clinic, unaided by their parent.

Measures

Perception of self-efficacy. Using a 9-item scale based on Senécal et al. (2000), participants rated the confidence they had in their ability to follow their dietary plan, given common barriers. The barriers, which were based on Glasgow et al. (1986) as well as Schlundt et al (1994), encompassed three kinds of situations, namely temptations (e.g. 'when someone offers me foods that are high in calories'), negative mood (e.g. 'when I feel annoyed or angry'), and uncontrollable situations (e.g. 'when I eat at a friend's house'). Each item was rated on a 10-point scale ranging from 0 (I am not confident at all that I can follow the dietary plan) to 10 (I am completely confident that I can follow the dietary plan). Cronbach's alpha for this sample was .86.

Perception of autonomous motivation. Perception of autonomous motivation was assessed using by the Dietary Self-care Motivation Scale for Adolescents with Diabetes (DSMS-AD; Senécal et al., 2010). This scale consists of 12 statements that answered the question: 'Why do you follow your dietary plan?' Three items

were used to assess distinct motivational constructs: intrinsic motivation (e.g. 'For the satisfaction of eating healthy'; α = .75); identified motivation (e.g. 'To feel better'; α = .83); controlled motivation (e.g. 'Because my doctor asks me to'; α = .72); and amotivation (e.g. 'I don't know what I'm getting out of it'; α = .79). Items were scored on a 5-point scale ranging from 1 (Do not agree at all) to 5 (I completely agree). In the present study, an index of autonomous motivation was computed using the following formula (Grolnick and Ryan, 1987): 2 (intrinsic motivation) + (identified regulation) – (controlled regulation) – 2 (amotivation). This weighting procedure forms a continuous variable from less (below zero) to more (higher than zero) relative autonomy toward dietary self-care. Thus, scores on this scale could vary from –12 to 12.

Perception of support from parents. A modified version of the Perception of Parents Scale (POPS; Robbins, 1994) was used to assess what SDT considers an optimal parenting support context. The POPS scale comprised 21 items for mothers and 21 for fathers. To obtain a measure assessing the interpersonal style of both parents, mothers' and fathers' items were merged into a single scale. Three items were then judged redundant and removed (e.g. 'My parents try to tell me how to run my life'; 'My parents aren't very sensitive to many of my needs'; 'My parents are often disapproving and unaccepting of me'). The remaining items were adapted to diabetes situations. The subscale included supportiveness items such as: 'My parents seem to know how I feel about my diabetes'; involvement items such as: 'My parents find time to talk with me about my diabetes'; and warmth items such as: 'My parents accepts me and likes me as I am'. Items were scored on a 7-point scale ranging from 1 (not at all true) to 7 (absolutely true). Cronbach's alpha for this sample was .90.

Perception of support from health care practitioners. Perception of autonomy support from practitioners (e.g. treating physician, nurse, and dietician) was assessed using a modified version of the Health Care Climate Questionnaire (HCCQ; Williams et al., 1996). The HCCQ includes items such as: 'I feel that my health care practitioners provided me with choices and options about handling my diabetes'. The original HCCQ encompassed 15 items. In this study, a shorter version of the HCCQ was completed by participants. A panel of health professional experts in diabetes and social psychology established that seven items were most representative of the SDT concept of autonomy support, which were scored using a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The internal consistency for this sample was .70.

Dietary self-care. The five items of the Diet subscale of the Summary of Diabetes Self-Care Activities (SDSCA; Toobert and Glasgow, 1994) assessed, over the previous seven days, overall dietary management, adherence to recommended caloric intake, percentage of time patients successfully added high-fibre foods to their meals, limited fat intake, and the percentage of meals that included high amounts of sweets and desserts. The first two items were scored on a 5-level descriptor scale ranging from 1 (never) to 5 (always) and the remainder were rated on a 5-point scale ranging from 1 (0%) to 5 (100%). Cronbach's alpha for this sample was .53. This scale was developed for use with adults, but has been adapted and used with adolescents with type 1 diabetes in prior studies (Nouwen et al., 2008).

Metabolic control. Medical charts of participating adolescents were reviewed to obtain values of glycosolated haemoglobin (HbA1c) measured at the outpatient appointment. HbA1c provides a retrospective indicator of average blood glucose levels over the past two to three months.

Statistical analyses

First, we built a SEM model in which dietary self-care was predicted by the main effects of

Table 1. Means, standard deviations, and correlations between all latent variables.

	M	SD	1	2	3	4	5	6
1-Perceived autonomy support from parent	5.37	0.97	–					
2-Perceived autonomy support HCP	5.57	0.94	.65**	–				
3-Perceived autonomous motivation	4.93	3.93	.56**	.65**	–			
4-Perceived self-efficacy	6.18	2.06	.40**	.45**	.58**	–		
5-Dietary self-care	3.41	0.56	.51**	.40**	.62**	.56**	–	
6-HbA1c	0.09	0.02	−.11	−.02	−.16**	−.13*	−.23**	–

Note:
HCP = Health care practitioners.
* p < .05; ** p < .01

gender (0 = female; 1 = male), age (measured continuously), and diabetes duration (measured continuously), as well as their two-way (gender × age, gender × duration of diabetes, age × duration of diabetes) and three-way (gender × age × duration of diabetes) interaction effects. As for the proposed motivational model of dietary self-care, it included five latent variables, each represented by three manifest indicators. Perception of autonomy support from parents and perception of self-efficacy were indexed according to the subscales of the measurement scale utilized. As for the remaining scales, three parcels were created as manifest indicators by aggregating items from the respective scale.

Fit indices. In this study, model adequacy was evaluated by the comparative fit index (Bentler, 1990), the non-normed fit index (Bentler and Bonnett, 1980), the root-mean-square error of approximation, and the χ^2 test statistic (Bollen, 1989). When significant, the χ^2 statistic is indicative of a lack of fit. However, the χ^2 test being particularly sensitive to sample size, the use of relative fit indices such as the CFI, NNFI, and RMSEA is strongly recommended. Models whose RMSEA is smaller than the threshold value of .05 are indicative of a close-fitting model, whereas values up to .08 represent acceptable errors of approximation, and values above .10 are indicative of poor fit (Browne and Cudeck, 1993). This means that the model is an adequate representation of the sampled data. As for the NNFI and the CFI, values above the criteria value of .90 are also indicative of a good fit (Hoyle, 1995).

Results

Model for dietary self-care

Results indicate that the χ^2 was non-significant, $\chi^2 = 7.969$ (df = 14), $p = .89$. The CFI (1.00), the NNFI (1.02), and the RMSEA (.00, *IC* [.00; .03]) indicated a good fit. Results reveal one main effect for diabetes duration ($\beta = -.30$; $p < .05$) and one two-way interaction effect for gender and diabetes duration on dietary self-care ($\beta = .26$; $p < .05$). Since the main effect of diabetes duration qualifies as an interaction with gender, it is not interpreted further. As for the 'gender × diabetes duration' effect, it suggests that girls with longer diabetes duration ($\beta = -.16$; p < .05) report poorer dietary self-care than boys ($\beta = -.03$; p = ns). Thus, the only factors included in the motivational model were gender, diabetes duration, and their interaction term.

Motivational model of dietary self-care

Preliminary analyses. A measurement model was tested prior to the estimation of the motivational model dietary self-care. In this confirmatory factor analysis (CFA), relations between latent variables and their corresponding indicators were estimated, with no specified structural relations. The fit of the model was good, $\chi^2(90) = 84.067$; NNFI = 1.01; CFI = 1.00, RMSEA = .00. Within each latent construct, the manifest

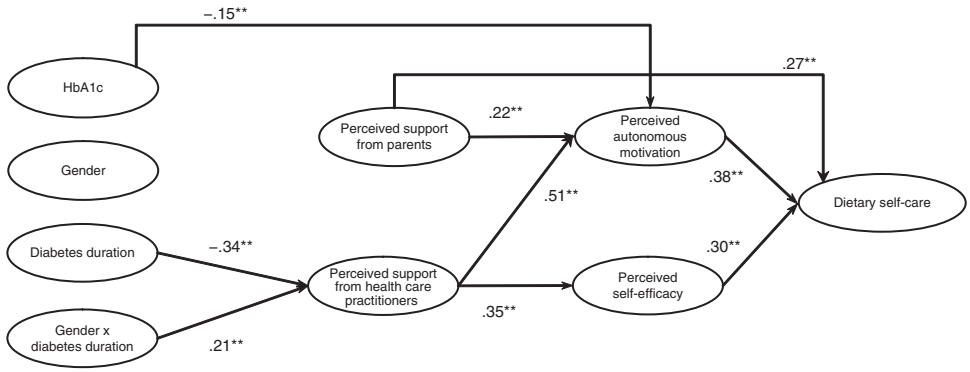

Figure 1. Final model of dietary self-care in relation to non-modifiable characteristics, contextual, and motivational factors.
** $p < .01$.

indicators were intercorrelated, with loadings ranging from .34 to .93.[1] Correlations between latent variables were significant and in the expected direction (see Table 1). We thus proceeded to test the proposed motivational model.

Structural equation modeling. The proposed model is adjusted for HbA1c levels and aims to verify whether non-modifiable characteristics affect perceptions of autonomy support from significant others, which in turn influence dietary self-care through motivational factors. Results showed a non-significant χ^2 ($p = .66$). Fit indices were satisfactory (χ^2 (122) = 114.90, CFI = 1.00; NNFI = 1.01, and RMSEA = .00). To rule out alternative explanations, this model, which assumes full mediation of motivational factors, was compared to a partial mediation model that included two additional direct paths from support from practitioners and from parents support to dietary self-care. The χ^2 result for the partial mediation model was also non significant ($p = .77$), and fit indices were indicative of a good fit (χ^2 (120) = 108.40, CFI = 1.00; NNFI = 1.01; and RMSEA = .00). A χ^2 difference test comparing the two models indicated that the partial mediated model fit the data significantly better ($\Delta\chi^2$ (2) = 6.5, $p = .04$). This latter model was thus selected and is presented in Figure 1 (for clarity, covariances among exogenous variables are not shown).[2]

Results indicate a significant negative path connecting diabetes duration and support from practitioners ($\beta = -.34$; $p < .01$). However, this effect is not interpreted further because it qualifies as an interaction with gender on support from practitioners ($\beta = .21$; $p < .01$). Result suggests that girls with longer diabetes duration perceive significantly less autonomy support from practitioners toward dietary self-care ($\beta = -.32$; $p < .01$) than their male counterparts ($\beta = -.11$; p = ns). No other significant path was found between non-modifiable characteristics and contextual variables. As for path connecting contextual and motivational factors, results reveal a positive path between parental autonomy support and autonomous motivation ($\beta = .22$; $p < .01$) as well as between autonomy support from practitioners and autonomous motivation ($\beta = .51$; $p < .01$) and perceived self-efficacy ($\beta = .35$; $p < .01$). Autonomous motivation is also negatively related to metabolic control ($\beta = -.15$; $p < .01$). Finally, results indicate that dietary self-care is positively and significantly related to autonomous motivation ($\beta = .38$; $p < .01$), self-efficacy ($\beta = .30$; $p < .01$), and parental autonomy support ($\beta = .27$; $p < .01$).

Discussion

The first objective of this study was to examine the main effect and interaction between gender,

age, and diabetes duration on dietary self-care in adolescents with type 1 diabetes. Results revealed that female adolescents who present longer diabetes duration are more likely to neglect their dietary self-care activities. The second objective was to determine why non-modifiable characteristics (and their interaction) are linked to dietary self-care. Based on SDT, a motivational model adjusted for metabolic control was tested, in which non-modifiable characteristics influence perceptions of contextual factors (i.e. autonomy support from parents and practitioners), which in turn predicts dietary self-care through motivational factors (i.e. autonomous motivation and self-efficacy). SEM analysis provided good support for a model with partial mediation. Implications of these results are discussed later.

Dietary self-care research

This study extends previous research through its emphasis on dietary self-care, the most decisive treatment for diabetes control, and yet the most difficult for adolescents to achieve (Delamater, 2000). Consistent with prior research, our findings support the need to consider non-modifiable characteristics in attempting to understand diabetes care in adolescents. Most importantly, by assessing the interactions between gender, age, and diabetes duration on dietary self-care, our results shed new light on prior conflicting results regarding gender differences. In this study, girls had greater difficulties than boys in adhering to their dietary recommendations. One key finding is that girls' dietary difficulties tended to increase with diabetes duration, and not with age. This finding goes beyond previous studies that have generally failed to verify whether diabetes duration affects the relationship between adolescents' gender and self-care. Nonetheless, our results concur with those of recent epidemiological studies that indicated that girls with longer diabetes duration present poorer metabolic control and greater diabetes complications than boys (Hanberger et al., 2008; Huang et al., 2004).

One explanation for these results is that the dietary restraints and constant focus inherent in living with diabetes occurs at a time when girls are more concerned than boys with weight and body shape. Perhaps the longer girls live with diabetes, the greater the toll dietary requirements exact on them, and the more likely they are to follow dietary recommendations for weight rather than metabolic control reasons. The finding that girls with diabetes are twice as likely to present with eating disorders than their peers without diabetes seems to support the contention that perceived dietary restraints exacerbate unhealthy eating practices (Daneman et al., 2002).

A contribution of this study is the demonstration of the relevance and validity of a motivational model to explain the mechanisms by which non-modifiable characteristics are linked to the dietary self-care behaviours of adolescents with diabetes. Our results partially support the hypothesis that non-modifiable characteristics influence perceptions of autonomy support from significant others. No effect of gender and/or diabetes duration was found on perceived parental autonomy support, meaning that adolescent participants perceived equivalent level of parental support. This result is not surprising, because parents are well aware of the critical importance of dietary care for their child's prognosis, and they would probably support dietary initiatives regardless of the child's characteristics. As for the autonomous actions of practitioners, our results indicate that girls with longer diabetes duration perceived significantly less support than boys. The question that arises here is why female adolescents perceive practitioners as being less autonomy supportive of their dietary efforts. SDT clearly indicates that males and females possess the same psychological needs, which can be enhanced (or thwarted) by the social context in which they evolve. One explanation for our results is that boys and girls are supported by their practitioners in dissimilar ways, practitioners being more controlling with girls than with boys. Perhaps practitioners' expectations

for dietary self-care are higher for girls than boys. Conversely, lower dietary self-care expectations for boys may make practitioners more inclined to provide them with guidance and praise for their dietary initiatives. Another plausible explanation lies in perceptual bias. Indeed, it is possible that some of our female participants have eating disorders. These disorders may be attributable to a low level of autonomy at the personality level (Strauss and Ryan, 1987) which led them to perceive the supporting actions of practitioners toward dietary self-care more negatively. Future studies should verify this perceptual bias hypothesis.

Our hypothesis that greater perceptions of autonomy support from parents and health care practitioners predict more optimal motivational resources toward dietary self-care is partially supported. Specifically, our results indicate that parents who are autonomy supportive foster feelings of autonomous motivation in their children toward dietary self-care. Furthermore, our results indicate that the more adolescents perceived that practitioners provided them with choice, information, and rational about dietary self-care, the more self-efficacious and autonomous they felt about their dietary behaviours. These results are consistent with prior research demonstrating that social support for diabetes care from multiple sources are crucial for adolescents' healthy functioning (Kyngäs et al., 1998; 2000). But contrary to our expectation, parents' supportive behaviours were not predictive of adolescents' perceptions of self-efficacy toward dietary self-care. Possible reasons for this may stem from the importance attached to practitioners opinion about dietary self-care, since they are specifically the ones who recommended the adoption of these activities. Future research should examine the means by which parents can facilitate feelings of self-efficacy in their adolescents toward the regulation of these recommended activities.

Finally, our hypothesis that more optimally motivational resources (i.e. high autonomous motivation and self-efficacy) predict better dietary practices was supported. Our results indicate that adolescents who present greater feelings of autonomous motivation and self-efficacy also present better dietary self-care. This result is in line with William and colleagues' findings that the more adult patients with type 2 diabetes perceived themselves as competent and autonomously regulated, the better they manage their dietary self-care activities and metabolic control (Williams et al., 2005; 2004). In addition, our results reveal an indirect relation from practitioners' autonomy supportive behaviours to dietary self-care, suggesting that motivational factors mediate this relationship. However, motivational factors could not fully account for the relationship between parental autonomy support and dietary self-care. We believe that this partial mediation may stem from the fact that much of diabetes care involves dietary choices made in the home for which parents generally play an active and direct role, such as for meal planning and preparation. Other mediators might therefore be examined to fully understand the relationship between these variables, including for example dietary knowledge and shared self-care responsibilities (Helgeson et al., 2008; Mehta et al., 2009).

Our findings have several limitations, each with implications for future research. First, the results are based mostly on self-reported data. Multiple evaluation sources should be used to further test the proposed model. In addition, our study includes a limited number of variables to understand dietary self-care. Other variables, such as need for support, weight concerns, dietary knowledge, and shared responsibilities should be included in further tests of the model. Next, as dietary behaviours are dynamic, meaning that they can change with developmental status, context, and disease course (De Civita and Dobkin, 2004), their assessment should preferably be ongoing in order to pinpoint when difficulties typically emerge in subsets of adolescents. Future longitudinal studies are also needed to ascertain temporal precedence among studied variables. Indeed, the use of a cross-sectional design does not allow establishing causal relations among variables. For example, metabolic control at baseline could be influenced

by motivational factors rather than being a predictor of perceived autonomy and self-efficacy toward dietary self-care. Future studies should examine the nature of these relations using longitudinal designs. Finally, as optimal motivational resources are linked to better dietary self-care, efforts should be devoted to the development and implementation of intervention intending to increase autonomous motivation and feelings of competence for dietary self-care in adolescents with type 1 diabetes. SDT based research has evidenced that supporting patients' autonomy will translate into more autonomous motivation and competence for health care change (Ryan and Deci, 2007). In the juvenile diabetes domain, intervention studies could aim to encourage parents to become more involved in their adolescent's care in an autonomy supportive manner. Audiotape feedback could be used to help parents to better support the dietary choices of their adolescent and to facilitate among them more optimal motivational resources for dietary care.

Notes

1. Results are available upon request from the corresponding author.
2. Although our results are consistent with SDT, some researchers have envisioned alternate models that could explain the relations between motivational factors and diabetes self-care. For example, Williams and his colleagues (2004) found that perceptions of autonomy support predict both autonomous motivation and self-efficacy, that autonomous motivation predicts self-efficacy, and that self-efficacy predicts change in patients' metabolic control. Accordingly, we tested a supplementary model (also adjusted for metabolic control) in which: (1) non-modifiable characteristics are linked to perceptions of contextual factors (i.e. autonomy support from parents and practitioners); (2) perceptions of contextual factors are linked to autonomous motivation; (3) autonomous motivation is linked to self-efficacy; and (4) self-efficacy is linked to dietary self-care. Although this alternate model exhibited satisfactory fit indices (χ^2 (123) = 136.09, CFI = .987; NNFI = .982; and RMSEA = .025), it had poorer fit indices comparatively to the full mediation model (χ^2 (122) = 114.90, CFI = 1.00; NNFI = 1.01, and RMSEA = .00) and the partial mediation model (χ^2 (120) = 108.40, CFI = 1.00; NNFI = 1.01; and RMSEA = .00) tested in this study.

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