The association between mindfulness and emotional distress in adults with diabetes: Could mindfulness serve as a buffer? Results from Diabetes MILES: The Netherlands

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Abstract People with diabetes have a higher risk of emotional distress (anxiety, depression) than non-diabetic or healthy controls. Therefore, identification of factors that can decrease emotional distress is relevant. The aim of the present study was to examine (1) the association between facets of mindfulness and emotional distress; and (2) whether mindfulness might moderate the association between potential adverse conditions (stressful life events and comorbidity) and emotional distress. Analyses were conducted using cross-sectional data (Management and Impact for Long-term Empowerment and Success—Netherlands): 666 participants with diabetes (type 1 or type 2) completed measures of mindfulness (Five Facet Mindfulness Questionnaire-Short Form; FFMQ-SF), depressive symptoms (Patient Health Questionnaire; PHQ-9), and anxiety symptoms (General Anxiety Disorder assessment; GAD-7). Hierarchical multiple regression analyses showed significant associations between mindfulness facets (acting with awareness, non-judging, and non-reacting) and symptoms of anxiety and depression ($\beta = -0.20$ to -0.33, all $p < 0.001$). These mindfulness facets appeared to have a moderating effect on the association between stressful life events and depression and anxiety (all $p < 0.01$). However, the association between co-morbidity and emotional distress was largely not moderated by mindfulness. In conclusion, mindfulness is negatively related to both depression and anxiety symptoms in people with diabetes and shows promise as a potentially protective characteristic against the influence of stressful events on emotional well-being.

Keywords Anxiety · Comorbidity · Depression · Diabetes · Mindfulness · Stressful life event(s)

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Introduction

People living with diabetes face several challenges, e.g., managing medications and coping with the prospect of long-term complications, such as retinopathy, neuropathy, kidney damage, and cardiovascular disease (Marshall & Flyvbjerg, 2006). To avoid or delay these complications, most people with diabetes have to manage their blood glucose concentrations using antihyperglycemic medication. Unsuccessful attempts to optimise blood glucose levels can result in very unpleasant hyperglycaemic or hypoglycaemic episodes, especially in people using insulin. Moreover, having long-term diabetes complications and the self-care involved to prevent them is often burdensome. Unsurprisingly, people with diabetes are at increased risk for impaired emotional well-being compared to the general population (Fisher et al., 2008; Nouwen et al., 2010). Indeed, 20–40 % of people with diabetes experience feelings of anxiety, depression, diabetes-specific or general distress (Fisher et al., 2008; Grigsby et al., 2002; Pouwer et al., 2010); and the presence of

multiple comorbidities places people at greater risk of impaired emotional well-being (de Groot et al., 2001; Egede, 2005; Koopmans et al., 2009; Pouwer et al., 2003). In addition to these health-related and diabetes-specific challenges, general life stressors, such as losing a job or loved one, are also associated with impaired emotional well-being (Koopmans et al., 2009). Often, it is the perceived uncontrollability of these events and conditions (diabetes-specific or not) that makes them adverse. However, people differ in the extent to which they are resilient in the midst of such adversities (Kabat-Zinn, 1990). It is of clinical interest to find out which factors, such as individual characteristics or coping skills, are responsible for these inter-individual differences. They could function as a so-called "buffer" against the negative effects of stressful situations/adversities on emotional well-being, especially when these factors or skills can be deployed or learned.

One factor that may play such a buffering role is mindfulness. In the past decade, there has been growing attention to the concept of mindfulness in the literature. Mindfulness is defined as paying attention to the present moment, in an open and nonjudgmental way (Kabat-Zinn, 1990). This attention and mode of awareness gives people a way of dealing with uncontrollable negative situations, negative feelings, and stressful thoughts (Kabat-Zinn, 1990). In addition, it is claimed to prevent the onset or exacerbation of automatic behaviour patterns responsible for reduced emotional well-being, such as worrying and rumination (Segal et al., 2002; Shapiro et al., 2006), and it facilitates relaxation (Nyklíček, 2011). Mindfulness can be seen as both a trait, a basic human characteristic that varies both between and within persons, and as a skill, that can be learned through meditation practice (Brown & Ryan, 2003). It is suggested that the concept consists of various measurable aspects: (a) non-reactivity to inner experience (*non-reacting*); (b) observing sensations, perceptions, thoughts, and feelings (*observing*); (c) *acting with awareness*; (d) verbalizing one's inner experience (*describing*); and (e) non-judging of experience (*non-judging*) (Baer et al., 2006). In previous research, as a trait, mindfulness has been associated with lower levels of emotional distress, in people with or without a chronic disease (Baer et al., 2006; Bränström et al., 2011; Brown & Ryan, 2003), though the relationship between the *observing* facet and well-being is less clear (Baer et al., 2006; Barnhofer et al., 2011; Bränström et al., 2011). In addition, mindfulness-based interventions have been found to be effective in improving people's well-being, including decreasing symptoms of general distress, anxiety and depression (Fjorback et al., 2011; Hofmann et al., 2010). Some of these effects have been found to be mediated by an increase in the participants' level of mindfulness (Bränström et al., 2010; Nyklíček et al., 2014; Nyklíček & Kuijpers, 2008; Vøllestad et al., 2011). To the best of our knowledge, the relationship between mindfulness as a trait or skill outside an intervention context and emotional well-being in people with diabetes has not been examined. Two randomized controlled trials did show that a mindfulness-based intervention reduced symptoms of anxiety and depression, but it is unclear whether these effects were mediated by an increase in mindfulness (Hartmann et al., 2012; van Son et al., 2013).

Evidence is emerging to suggest a potential buffering role of mindfulness. For example, one study in the general population that tested the moderating role of mindfulness showed that associations of perceived stress with depressive symptoms and perceived health were less strong for people with higher levels of trait mindfulness (Bränström et al., 2011). Two other studies showed that mindfulness moderated the relation between neuroticism and current depressive symptoms: neuroticism was only or more strongly associated with depression in those with low to medium levels of trait mindfulness (Barnhofer et al., 2011; Feltman et al., 2009). In addition, mindfulness moderated the association between unavoidable distressing experiences and mental health (psychological symptoms and negative affect) in another study by Bergomi et al. (2013). Moreover, in a stressful laboratory task, trait mindfulness seemed to moderate the onset of negative affect and also cortisol responses to the stressor (Brown et al., 2012). In people with a somatic condition, only one study has been conducted. This study of people with rheumatoid arthritis showed that the negative association between disability and psychological well-being across a 12-month period was diminished for those with higher levels of baseline mindfulness (Nyklíček et al., submitted). Although the results of these studies all point in the same direction, more research is needed to extend the findings to other populations and contexts, such as adverse events and situations in people with diabetes.

The first objective of the present study was to test the hypothesis that people with diabetes who report a higher level of mindfulness facets (non-judging, acting with awareness, non-reacting, and describing) also report lower levels of emotional distress. The second and main objective was to examine the hypothesis that mindfulness facets act as moderators in the possible associations of medical comorbidity and stressful life events with emotional distress. That is, in people with a higher level of mindfulness facets, the associations of stressful life events and comorbidity with anxiety and depression are diminished.

Methods

Participants and procedure

This research is part of Diabetes Management and Impact for Long-term Empowerment and Success (MILES)—The Netherlands, a national, online survey of people with dia-

betes. The rationale and methods of this large-scale study have been published elsewhere (Nefs et al., 2012). Briefly, it involves a national online survey among adults with diabetes (type 1 and 2), conducted in fall 2011. There were multiple methods of recruitment, one of which was via an advertisement in the magazine of the Dutch Diabetes Association (Diabetesvereniging Nederland). The survey was accessible online from September 6th to October 31st 2011. The questionnaires covered a wide range of topics, including general health, self-management, emotional well-being and the amount and satisfaction of contact with health care providers. In addition to a core set of questionnaires, which was completed by all participants (N = 3,960), there were five additional modules to which participants were allocated at random. The present sample consists of those participants who were allocated to the mindfulness module (N = 666).

Measures

Mindfulness

Mindfulness was measured by means of the Five Facet Mindfulness Questionnaire short form (FFMQ-SF) (Bohlmeijer et al., 2011). This questionnaire assesses five components of mindfulness: observing (4 items), describing (5 items), acting with awareness (5 items), non-judging (5 items), and non-reactivity (5 items) (Baer et al., 2006). Respondents are asked to rate the extent to which each statement is true for them on a five point Likert scale ranging from 1 (never or very rarely true) to 5 (very often or always true) (Bohlmeijer et al., 2011). The FFMQ-SF has been shown to be reliable and valid, with Cronbach's α of the subscales ranging from 0.75 to 0.87 (Bohlmeijer et al., 2011). In the present sample, Cronbach's α was 0.75 for observing; 0.79 for describing; 0.82 for acting with awareness; 0.73 for non-judging; and 0.71 for non-reacting.

General emotional distress

Emotional distress was measured by means of two questionnaires: the Patient Health Questionnaire (PHQ-9) to measure depressive symptoms (Kroenke et al., 2001) and the Generalized Anxiety Disorder assessment (GAD-7) to measure symptoms of anxiety (Spitzer et al., 2006).

The PHQ-9 evaluates the presence of the nine core criteria for major depressive disorder (Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Text Revision (DSM-IV-TR), 1995) (Kroenke et al., 2001). Items are answered using a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day). The total score of this scale ranges from 0 to 27, with higher scores representing higher levels of depressive symptoms (Kroenke et al., 2001). The PHQ-9 has proven validity and reliability (Cameron et al., 2008; Kroenke et al., 2001). In the present sample, the Cronbach's α was 0.87.

The GAD-7 consists of the seven core symptoms of generalized anxiety disorder [DSM-IV (Diagnostic and Statistical Manual of Mental Disorders. 4th ed. Text Revision (DSM-IV-TR), 1995)] (Spitzer et al., 2006). Respondents indicate how often (during the last 2 weeks) they have been bothered by each symptom, using a four-point Likert scale (0 = not at all, 3 = nearly every day). The total score ranges from 0 to 21, with higher scores representing higher levels of anxiety symptoms (Spitzer et al., 2006). The GAD-7 has been shown to be valid and reliable (Löwe et al., 2008; Spitzer et al., 2006). In the current sample, the GAD-7 had a Cronbach's α of 0.89.

Stressful life events and the presence of comorbidity

Stressful life events were measured by means of a single self-report item: "Have you experienced a stressful life event (or events) in the past year?" (yes/no). In addition, respondents indicated (yes/no) whether they had certain pre-specified comorbid conditions, including diabetic and non-diabetic comorbidities and complications, which often are perceived as adverse: myocardial infarction; stroke; peripheral arterial disease; chronic heart failure; diabetic nephropathy; diabetic retinopathy; diabetic neuropathy; diabetic foot problems; cancer; asthma or COPD; stomach, liver, or intestinal disease; skin disease; thyroid disorder; rheumatoid arthritis; osteoporosis; migraine; epilepsy; restless legs syndrome; multiple sclerosis; and Parkinson disease. Based on the literature, which states that especially the existence of two or more comorbid conditions influences emotional distress (de Groot et al., 2001; Egede, 2005; Koopmans et al., 2009), this operationalization of comorbidity comprised three categories: no comorbid condition/complication; one comorbid condition/complication; two or more comorbid conditions/complications.

Demographic and clinical variables

Information included sex, age, marital status, education, current employment, diabetes type, diabetes duration, current treatment regimen, and Body Mass Index (BMI). These were all based on self-report. In addition, respondents were asked to provide their most recent HbA$_{1c}$ or tick the box "I don't know".

Statistical analyses

Data were analyzed using SPSS version 19 (IBM SPSS Statistics, Somers, New York). Correlations between vari-

ables were calculated with Pearson product-moment correlations. Hierarchical multiple linear regression analyses were used to study the association between the independent and dependent variables. The dependent variables anxiety and depression were examined separately. In step 1, demographic and clinical variables (except comorbidity) were included as potential correlates of emotional distress. In step 2, comorbidity and stressful events were entered into this model (the output also generates their unique contributions to the outcome variable). Regarding comorbidity, because the largest effect was expected by two or more comorbidities (see above), the three categories (no, single or two or more comorbidities) were recoded into two orthogonal dummy variables: single comorbidity (versus the other categories) and multiple comorbidity (versus the other categories). In sensitivity analysis, also a continuous score of the number of comorbidities was used (square root transformed to normalize the distribution). In step 3, the mindfulness facets were included (to test hypothesis 1).

To test whether the mindfulness facets moderated the association between comorbidity and stressful life events with anxiety and depression (hypothesis 2), interactions between comorbidity and mindfulness facets and between stressful life events and mindfulness facets (product terms) were entered into a model. This was done both in separate analyses for each interaction term to examine their raw effect and in analyses in which the significant separate effects per adversity factor (stressful life events or comorbidities) were included together to examine their relative unique contributions. In all moderator analyses, demographic and clinical variables as well as the main effects were included and thus controlled. In order to deal with multicollinearity in the moderator analyses, the mindfulness facets (and the square-root transformed comorbidity variable, where applicable) were centered around their means (Aiken & West, 1991). In case of a significant moderator effect by a mindfulness facet, for interpretation of the results, the mindfulness subscales were categorized into a low (<-1 standard deviation (SD) below the mean), medium (from -1 SD to $+1$ SD), or high (>1 SD above the mean) mindfulness facet group (Aiken & West, 1991) for which separate regression analyses were run. This allowed examination of the effects of comorbidity and stressful events on emotional distress per mindfulness facet group. Given the higher risk of a type I error due to multiple testing, the alpha level for significance was set at 0.005 for all analyses [Bonferroni correction of the alpha of 0.05 divided by 10 (i.e., 5 mindfulness facets by 2 adversity factors)].

Results

In the present study, the amount of missing data for most measures was negligible (i.e., for mindfulness n = 4; for

anxiety and depression n = 0). An exception was HbA_{1c}, because 181 participants indicated that they did not know their most recent HbA_{1c}.

Descriptive analyses

Demographic and clinical characteristics are presented in Table 1. The sample consisted of 666 persons with diabetes (45 % type 1; 55 % type 2). The mean age was 55 years (SD = 14) and the number of men and women was almost equal (53 % men). In general, respondents were highly educated (43 % had high-level vocational education or university) and were living with a partner (82 %). The average duration of diabetes was 17 years (SD = 13), and for most people, insulin-therapy was part of the diabetes treatment (total 72%; 49 % of people with type 2 diabetes). Fifty-three percent of the participants had one or more comorbid conditions or complications and, on average, they had a BMI of 27.8 (SD = 6.2). The mean depression and anxiety scores were 4.4 (SD = 4.8) and 2.9 (SD = 3.5) respectively, indicating that the current sample, on average, reported a minimal level of emotional distress. Nevertheless, according to criteria for elevated levels of depressive symptoms (moderate: ≥ 10) (Kroenke et al., 2001) and anxiety symptoms (≥ 10) (Löwe et al., 2008), 13.5 % had moderate depressive symptoms and 5.6 % had elevated anxiety. Norm scores regarding the mindfulness questionnaire are not available to date, but the current sample scored somewhat higher on all mindfulness facets, except observing, compared to a sample of people with mild to moderate symptoms of anxiety or depression (Bohlmeijer et al., 2011).

Demographic, clinical, and adversity variables as correlates of emotional distress

In the hierarchical multiple regression analyses, demographic and clinical variables (entered in step 1) explained 10 and 6 % of the variance in depression and anxiety, respectively. After entry of comorbidity and stressful life events (step 2), the total variance explained by the model was 20 % for depression ($F(12,631) = 13.45$, $p < 0.001$; $\Delta R^2 = 0.11$, $\Delta F(3,631) = 27.75$, $p < 0.001$) and 15 % for anxiety ($F(12,631) = 9.41$, $p < 0.001$; $\Delta R^2 = 0.09$, $\Delta F(3,631) = 22.82$, $p < 0.001$).

For depression, stressful life events were a significant predictor ($\beta = 0.27$, $p < 0.001$), as well as multi-comorbidity (≥ 2 comorbidities in contrast to ≤ 1 comorbidity) ($\beta = 0.13$, $p = 0.003$). Other (marginally) significant variables were: age ($\beta = -0.26$, $p < 0.001$) and BMI ($\beta = 0.11$, $p = 0.006$). For anxiety, stressful life events were also a significant predictor ($\beta = 0.27$, $p < 0.001$), while having multi-comorbidity showed a trend towards

Table 1 Characteristics of the sample

	Total (n = 666)
Demographics	
Age[a], M (SD)	55 (14)
Men, n (%)	314 (53)
High educational level[b], n (%)	289 (43)
Having a partner, n (%)	543 (82)
Clinical characteristics	
Type 1 diabetes, n (%)	299 (45)
Type 2 diabetes, using insulin, n (%)	180 (27)
Type 2 diabetes, not using insulin, n (%)	187 (28)
HbA$_{1c}$ (mmol/mol)[c], M (SD)	56.1 (12.0)
Duration of diabetes[a], M (SD)	16.5 (13.1)
Comorbidity[d], M (SD)	1.1 (1.6)
None, n (%)	314 (47)
One, n (%)	176 (26)
Two or more, n (%)	176 (26)
Body Mass Index, M (SD)	27.8 (6.2)
Emotional distress	
Depressive symptoms (PHQ9), M (SD)	4.4 (4.8)
Anxiety symptoms (GAD7), M (SD)	2.9 (3.5)
Mindfulness (FFMQ-SF)	
Total score, M (SD)	84.1 (11.8)
Observing, M (SD)	13.6 (3.6)
Describing, M (SD)	18.3 (3.9)
Actaware, M (SD)	19.3 (3.8)
Non-judging, M (SD)	17.7 (4.0)
Non-reacting, M (SD)	15.3 (3.9)
Stressful life event(s) in past year, n (%)	290 (44)

PHQ-9 Patient Health Questionnaire, *GAD-7* Generalized Anxiety Disorder scale, *FFMQ-SF* Five Facet Mindfulness Questionnaire-Short Form

[a] In years

[b] High-level vocational education and university

[c] Most recent HbA$_{1c}$

[d] Comorbid conditions or complications

significance (β = 0.12, p = 0.01). Of all the other variables, only age showed a significant positive association with anxiety (β = −0.25, p < 0.001).

Association of mindfulness facets with emotional distress

The zero order correlations between the mindfulness subscales and anxiety/depression were negative and small-to-medium sized (median r = −0.30; range r = −0.19 to −0.52, all p < 0.001), except for the observing facet that showed small negative correlations with depression and anxiety (r = −0.13, p < 0.01 and r = −0.08, p < 0.05 respectively).

After entry of the mindfulness facets into the regression model described above (step 3), the explained variance for depression was 47 % (F(17,626) = 31.96, p < 0.001; ΔR^2 = 0.26, ΔF(5,626) = 61.04, p < 0.001) and for anxiety 42 % (F(17,626) = 26.24, p < 0.001; ΔR^2 = 0.26, ΔF(5,626) = 56.69, p < 0.001). For depression, three out of five mindfulness facets were significant predictors: acting with awareness (β = −0.33, p < 0.001), non-judging (β = −0.20, p < 0.001), and non-reacting (β = −0.22, p < 0.001) (Table 2). Only in an analysis in which the mindfulness facets were included in step 3 of the model separately (instead of all together), describing was a significant correlate also (β = −0.30, p < 0.001). Stressful life events, multi-comorbidity, age, and BMI remained significant predictors in the model for depression. Also for anxiety, acting with awareness, non-judging, and non-reacting were significantly associated with anxiety (β = −0.30, −0.27, −0.20 respectively, all p < 0.001), while stressful life events and age remained significant covariables (Table 2).

Moderator effect of mindfulness

To examine the moderating effect of mindfulness on the association of multi-comorbidity and stressful life events with anxiety and depressive symptoms, the interactions between these adversities and the separate mindfulness facets were entered at step 4 of the hierarchical multiple regression analyses, while controlling for demographic and clinical variables as well as the main effects of stressful life events, multi-comorbidity, and the particular mindfulness facet(s).

Three mindfulness facets particularly showed significant moderating effects in the relationship between stressful life events and depressive symptoms, as was shown by the significant interaction terms (Table 2): acting with awareness (ΔR^2 = 0.010, β = −0.14, p = 0.002), non-judging (ΔR^2 = 0.014, β = −0.16, p < 0.001), and non-reacting (ΔR^2 = 0.012, β = −0.14, p = 0.001). When these three significant mindfulness moderators were entered together in the analysis, only non-judging still showed an effect, although significant only when not Bonferroni corrected (β = −0.09, p = 0.047). None of the mindfulness facets moderated the association between multi-comorbidity and depressive symptoms.

For anxiety, acting with awareness and non-judging significantly moderated the association with stressful life events (ΔR^2 = 0.030, 0.031, β's = −0.25, −0.24 respectively, both p < 0.001), while non-reacting showed a trend for a moderator effect (ΔR^2 = 0.010, β = −0.13, p = 0.007) (Table 2). When these three mindfulness moderators were entered together in the analysis, non-judging and acting with awareness still showed an effect,

Table 2 Hierarchical multiple linear regression and moderator analyses on adversities and mindfulness facets in relation to emotional distress

	Total regression model			
	Depressive symptoms		Anxiety symptoms	
	β	p	β	p
Covariables				
Female gender	02	0.57	−0.01	0.79
Age	−0.13	**0.001**	−0.14	**0.002**
Single	0.06	0.07	−0.01	0.89
Highly educated[a]	0.01	0.75	0.03	0.38
Body Mass Index	0.12	**0.001**	0.02	0.57
Diabetes duration	−0.04	0.32	−0.04	0.29
Diabetes type 2	0.01	0.8	0.01	0.85
Insulin therapy	0.03	0.44	0	0.98
Single comorbidity	0.04	0.29	−0.01	0.8
Multi-comorbidity (≥2)[b]	0.11	**0.003**	0.09	0.03
Stressful life event	0.19	**<0.001**	0.19	**<0.001**
Mindfulness				
Observing	0	0.9	0.01	0.85
Describing	−0.04	0.25	−0.02	0.61
Act aware	−0.33	**<0.001**	−0.3	**<0.001**
Non-judging	−0.2	**<0.001**	−0.27	**<0.001**
Non-reacting	−0.22	**<0.001**	−0.2	**<0.001**
Moderator analyses[c]				
Stressful event × observing	−0.07	0.13	−0.07	0.18
Stressful event × describing	−0.09	0.05	−0.08	0.11
Stressful event × act aware	−0.14	**0.002**	−0.25	**<0.001****
Stressful event × non-judging	−0.16	**<0.001***	−0.24	**<0.001***
Stressful event × non-reacting	−0.14	**0.001**	−0.13	0.007
Multi-comorbidity × observing	−0.1	0.01	−0.11	0.01**
Multi-comorbidity × describing	0	0.92	0.06	0.14
Multi-comorbidity × act aware	−0.08	0.05	−0.07	0.08
Multi-comorbidity × non-judging	−0.06	0.11	−0.12	**0.003****
Multi-comorbidity × non-reacting	−0.05	0.23	−0.04	0.31

* $p < 0.05$ or ** $p < 0.005$ significant moderator in analysis together with other moderators that were significant in separate analysis with the same adversity (stressful event or multi-comorbidity)

[a] High-level vocational education or university

[b] Comorbid conditions or complications

[c] These are separate analyses per moderator, but controlled for demographic and clinical variables and the main effects of the variables in the interaction term; in bold are effects significant when Bonferroni corrected ($p < 0.005$)

although only the latter was significant when Bonferroni corrected (β = −0.13, $p = 0.006$ and β = −0.15, $p = 0.004$, respectively). Regarding the association between multi-comorbidity and anxiety, only non-judging showed a moderating effect ($\Delta R^2 = 0.010$, β = −0.12, $p = 0.003$). When together with the observing moderator variable, both non-judging and observing showed moderating effects (β = −0.14, $p < 0.001$ and β = −0.12, $p < 0.001$, respectively).

These results were highly similar in an analysis using the continuous (square rooted) comorbidity variable instead of the dichotomous variables, except that (a) the moderating effect of non-reacting on the association between stressful life events and anxiety became significant ($p = 0.004$), while the effect of observing on the association between comorbidity and anxiety in the simultaneous analysis with non-judging was not significant (β = −0.05, $p = 0.13$).

When examining the analyses based on trichotomized mindfulness variables (for illustrative purposes), in general, for people scoring high (>1 SD above the mean) on the particular mindfulness facet, the association between

Fig. 1 Relationship between stressful life events, comorbidity, and emotional distress for different mindfulness facets. Association between stressful life events and depression, moderated by acting with awareness (**a**), non-judging (**c**), and non-reacting (**e**); association between stressful life events and anxiety, moderated by acting with awareness (**b**) and non-judging (**d**); **f** association between comorbidity and anxiety, moderated by non-judging; low = <−1 SD below mean of mindfulness facet; medium = −1 SD to +1 SD on mindfulness facet; high = >+1 SD above mean of mindfulness facet
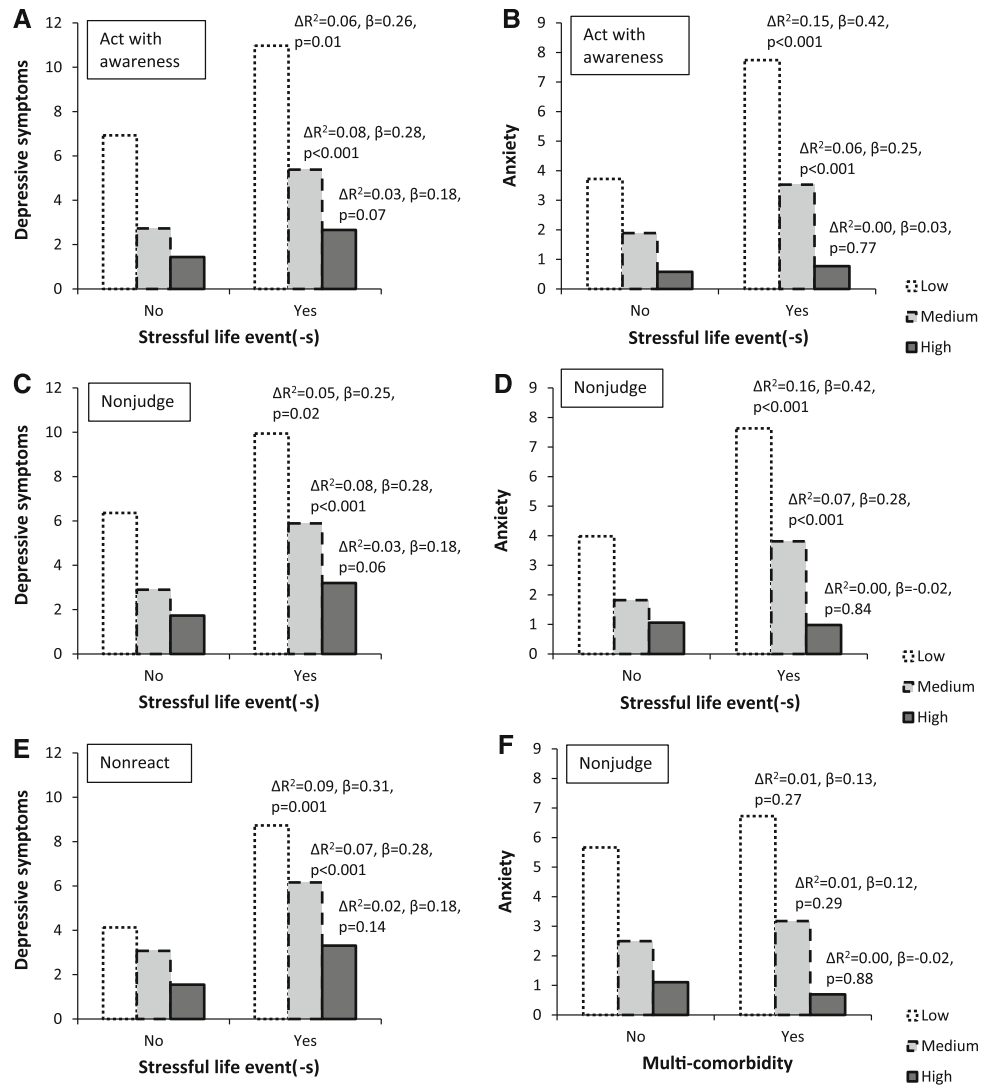
stressful life events and anxiety and depression was not significant, while for people scoring medium (−1 to 1 SD) or low (<−1 SD below the mean), the association was significant (Fig. 1).

Discussion

The aims of the present study were (1) to examine the relation between facets of mindfulness and emotional distress in adults with diabetes and (2) to test whether mindfulness could statistically moderate any association between stressful life events or comorbidity and emotional distress. As hypothesized, some of the mindfulness facets were independently associated with feelings of anxiety and depression. Altogether, the mindfulness facets explained an additional 26 % of the variance in both anxiety and depression, after controlling for demographic and clinical variables (including comorbidity) and stressful life events.

In particular, lower scores on *acting with awareness*, *non-judging*, and *non-reacting* were significantly associated with higher scores on anxiety and depression, while *observing* and *describing* yielded no significant associations. These findings are consistent with previous research in other populations. For example, Baer et al. (2006) also found the facets *acting with awareness*, *non-judging*, and *non-reacting* to be most important in predicting psychological symptoms in a sample of undergraduates, accounting for additional explained variance above the other facets, while *describing* did not. *Observing* did not show a negative association with psychological symptoms in their study. In addition, Bränström et al. (2011) found, in a general population sample, *non-judging*, *acting with awareness*, and *non-reacting* to be significantly associated with anxiety, and the latter two facets also with depression. In their study, *describing* was only related to positive affect, while *observing* yielded no significant association with well-being.

Stressful life events and multi-comorbidity were significantly associated with levels of depression and anxiety, though multi-comorbidity to a lesser extent than stressful life events. The three previous significant mindfulness facets (*acting with awareness*, *non-judging*, and *non-reacting*) each moderated the association between stressful life events and emotional distress; in participants who scored high on these mindfulness facets, stressful life events were not associated with feelings of anxiety and depression. Thus, these mindfulness facets might have been a protective characteristic against the adverse effect of stressful events. These findings correspond with previous research in general populations that examined a potential buffering role of mindfulness: mindfulness moderated the associations between (1) neuroticism and depressive symptoms (Barnhofer et al., 2011; Feltman et al., 2009); (2) unavoidable distressing events and mental health indices (Bergomi et al., 2013), and (3) perceived stress and depression, especially regarding the mindfulness facets *acting with awareness*, *non-judging*, and *non-reacting* (Bränström et al., 2011).

Consistent with previous research (Koopmans et al., 2009), having two or more comorbid conditions was associated with more depressive symptoms and to a lesser extent with higher levels of anxiety. In contrast to our expectations, in general, mindfulness facets did not diminish this association, indicating that the relationship between multi-comorbidity and emotional distress was of equal magnitude for those with high levels of mindfulness as for those with low levels. An exception was *non-judging* in relation to the association between multi-comorbidity and anxiety, reflecting that for people who scored high on the non-judging facet of mindfulness, having multiple comorbid diseases was not associated with anxiety. Nonetheless, perhaps for dealing with a chronic stressor, such as comorbid medical diseases, high trait mindfulness is not enough and actual mindfulness meditation practice may be necessary. This hypothesis is supported by research on the effect of mindfulness interventions, showing improvements in depression in people with chronic pain (Kabat-Zinn, 1982) and severe medical illnesses, such as cancer (Foley et al., 2010).

This is the first study to show a moderator effect of facets of mindfulness for the association between adversities and emotional distress in people with diabetes. Since emotional distress in people with diabetes is related to lower quality of life and glycemic control (Lustman et al., 2000; Schram et al., 2009), factors associated with emotional distress are worthy of investigation. Hence, the suggestion that mindfulness is a potential protective factor for maintaining emotional well-being for people with diabetes might be of relevance in clinical practice. Mindfulness is a human characteristic that can be cultivated through training and practice. The cultivation of mindfulness is the central component of mindfulness-based interventions. Two recent randomized controlled trials showed the effectiveness of a mindfulness intervention in the reduction of feelings of depression, general stress, and anxiety in people with diabetes (Hartmann et al., 2012; van Son et al., 2013). In clinical care, in addition to referring people with diabetes and comorbid emotional problems to a mindfulness intervention, it seems worthwhile to examine if such an intervention may also be beneficial for patients at risk for depression or anxiety (i.e., people high on neuroticism or who have experienced stressful life events).

Limitations

The current study has several limitations, many of which are discussed elsewhere (Nefs et al., 2012). First, the cross-sectional nature of the data does not allow statements about causality. Hence, instead or besides the hypothetical buffer effect by mindfulness, it might be that people who experience minimal emotional distress, even despite stressful life events, naturally have less difficulty being mindful. As a result of lower emotional distress, they may ruminate less, making it easier to be more attentive and less judgmental. These alternatives need not be mutually exclusive. Nevertheless, available evidence supports a direction of causality from mindfulness to lower emotional distress, since research has shown that mindfulness-based interventions have a positive influence on anxiety and depressive symptoms (Hofmann et al., 2010) and that these effects are (partly) mediated by an increase in levels of mindfulness (Bränström et al., 2010; Nyklíček et al., 2014; Nyklíček & Kuijpers, 2008; Vøllestad et al., 2011). In addition, one recent study that measured weekly change in mindfulness during a mindfulness intervention showed that an increase in mindfulness preceded the reduction of perceived stress (Baer et al., 2012). Nonetheless, prospective data from cohort studies and randomized controlled trials are necessary to more rigorously test the buffering potentials of mindfulness. Second, all measures were based on self-report and so potentially subject to reporting bias. This includes diabetes type, BMI, HbA$_{1c}$, and comorbidity. For instance, there is an increased risk of reporting a false-positive disease status in people with emotional problems (Baumeister et al., 2010). In addition, the assessment of mindfulness by means of self-report is currently subject to debate (Grossman, 2008), yet, to date, it remains the most used and viable approach for measuring mindfulness (Sauer et al., 2013). In addition, research has shown that the FFMQ has adequate psychometric properties (i.e., good reliability and predictive validity) (Baer et al., 2006). Moreover, for a more in-depth analysis of mindfulness, a recent review recommended using the FFMQ (Sauer et al.,

2013). The assessment of stressful life events in the past year by just one item misses the rigour and detail of using an extensive life events checklist. This may have introduced recall bias. Furthermore, the current sample of people with diabetes is not representative for the general Dutch diabetes population (e.g., in the present sample, a relatively large group of people with diabetes type 2 take insulin), as the way of recruitment probably resulted in a selection bias of those who are actively engaged in their diabetes care or for whom diabetes is explicitly present in their daily lives (Nefs et al., 2012). This might also explain the relatively low levels of anxiety and depressive symptoms in the current sample, again limiting the generalizability of the findings.

In conclusion, in the current study, mindfulness was associated with lower levels of depression and anxiety in people with diabetes, in particular the mindfulness facets acting with awareness, non-judging, and non-reacting. In addition, results of this study suggest that these latter mentioned mindfulness characteristics may have the potential to buffer against the adverse influence of stressful life events on depressive and anxious feelings. Hence, mindfulness-based interventions might be valuable to apply in the clinical care of people with diabetes who experience stressful life events. However, first longitudinal and intervention studies are required to more rigorously examine the protective potential of mindfulness facets in this population.

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