



Dispositional Mindfulness and Its Moderating Role in the Predictive Association Between Stressors and Psychological Symptoms in Adolescents

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Abstract

Objectives Dispositional mindfulness (DM) has emerged as an important mental health factor. DM contains many dimensions; however, each dimension's specific role and the mechanisms through which they contribute toward health are not yet clear. Therefore, this study's primary goal is to examine whether DM dimensions attenuate the association between stress and internalizing/externalizing problems in adolescents.

Methods The study involved a sample of 737 participants (51.2% girls) aged from 12 to 18 years. They completed measures of five dimensions of mindfulness, stressors, and psychological symptoms (somatic complaints, anxious/depressed, attention problems, aggressive behavior, and rule-breaking behavior) at the beginning of the study, and the latter (measures of psychological symptoms) were completed again at a 6-month follow-up.

Results All increased DM dimensions, except non-reactivity and non-judging, were found to predict fewer psychological problems over time, with acting with awareness being especially prominent ($p = .02$). Increased describing and non-judging were found to attenuate positive associations between stress and symptoms ($p = .03$), whereas observing increased this association ($p < .05$). Moreover, an interaction between DM dimensions emerged, increased non-judging predicted less internalizing and externalizing symptoms in youth with higher levels of acting with awareness ($p = .02$).

Conclusions Future intervention studies could include techniques to improve the capacity for acting with awareness, and the inclusion of techniques aimed at enhancing other dimensions should be conditioned by the nature of the psychological problems that are being targeted in each intervention.

Keywords Mindfulness · Stressors · Psychological symptoms · Adolescents

Adolescence is a period of many changes, such as physical growth, changes in social roles, and family and school transitions (Compas 1987), which entail a series of risks (Steinberg 2005). All these changes are usually associated with higher levels of stress, which contributes to the development of internalizing and externalizing problems in childhood and adolescence (Kim et al. 2003; Rudolph et al. 2000). It is important to identify protective and resilience-related factors that can buffer the negative influence of stress in young people's psychological

problems. Dispositional mindfulness (DM) has been proposed as a resilience factor as it is negatively associated with several psychological problems in adolescents (Calvete et al. 2017; Tan and Martin 2012). DM has been conceptualized as non-evaluative consciousness focused on the present that arises as a result of intentionally focusing one's attention on sensations, thoughts, and feelings as they are happening (Williams et al. 2007). One of the explanations for the beneficial role of DM is that it might reduce the impact of stress on psychological problems, a hypothesis that has been examined in a relatively small number of studies for several types of stressors and psychological symptoms both in adult samples (Bergin and Pakenham 2016; Dixon and Overall 2016) and samples of adolescents (Calvete et al. 2017; Ciesla et al. 2012).

One of the difficulties in drawing conclusions from previous studies is that mindfulness is not a unidimensional construct as it is made up of several dimensions or facets. For example, Bishop

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et al. (2004) suggested that DM is composed of two different dimensions: self-regulation of attention, and orientation toward one's experiences in the present moment. Later, Baer et al. (2006) developed the Five Facet Mindfulness Questionnaire (FFMQ), which measures five dimensions: acting with awareness (the capacity to be focused on the present, without distractions, and without acting on automatic pilot); non-judging of experience (the capacity not to judge one's own emotions, feelings, and thoughts); non-reactivity to inner experience (the capacity to avoid getting carried away by thoughts and feelings); describing (the capacity to describe or label feelings and thoughts with words); and observing (the capacity to attend to sensations, perceptions, thoughts, and feelings). There is considerable overlap between these five dimensions and other dimensions measured through other DM instruments (for a review, see Quaglia et al. 2016). Using the five-dimension model, previous studies have found mixed results for the associations between DM dimensions and psychological symptoms (see, for a review, Tomlinson et al. 2018), and more research is needed to examine these relationships (Quaglia et al. 2016). Furthermore, to our knowledge, very few studies have examined whether DM dimensions attenuate the association between stress and psychological problems, although the examination of this buffering effect is important to understand the mechanisms through which DM is beneficial for mental health. In the available literature, two cross-sectional studies have examined the moderating role of the five dimensions with different results: Van Son et al. (2015) found that acting with awareness, non-judging of experience, and non-reactivity to inner experience reduced the association between stress and symptoms of anxiety and depression in adults. Bergin and Pakenham (2016) found that describing and observing were the dimensions that reduced the association between stress and symptoms in university students.

Although cross-sectional studies can provide a preliminary insight about the associations between DM dimensions and psychological problems, longitudinal research is necessary to establish temporal relationships between variables to better conclude if DM predicts changes in psychological problems over time. Table 1 displays a summary of the most relevant findings per dimension obtained from longitudinal studies. As observed, the majority of the studies have focused on depressive symptoms with very few examining the relationship between DM and externalizing problems. The dimension that has received the most attention in the literature is acting with awareness, in part because many studies have used the Mindful Attention Awareness Scale-Adolescents (MAAS-A; Brown et al. 2011) to measure DM. Moreover, most of the studies have been conducted with adult samples (see for exceptions, e.g., Calvete et al. 2019; Ciesla et al. 2012). In terms of longitudinal evidence for direct effects, the results show that in general, and with a few exceptions (Calvete et al. 2017; Petrocchi and Ottaviani 2016), acting with awareness predicts fewer symptoms of depression over time in both

adults and adolescents (e.g., Ciesla et al. 2012; Dixon and Overall 2016). The results are mixed for non-judging of experience, with findings from some studies showing that non-judging of experience predicts more positive affect (Blanke et al. 2018) and less depression (Petrocchi and Ottaviani 2016), while other findings indicate that non-judging of experience does not predict changes in depression (Ciesla et al. 2012). In the case of non-reactivity to inner experience, describing, and observing, past studies have not found significant results for these dimensions as predictors of less depression. An exception is the study of Royuela-Colomer and Calvete (2016), where non-reactivity to inner experience predicted less depression over time in adolescents.

The studies about whether DM attenuates the association between stress and psychological problems are even scarcer, and the available findings are mixed. In some studies, for example, acting with awareness attenuated the predictive association between stress and depression in adults (Dixon and Overall 2016) and externalizing problems in adolescents (Calvete et al. 2017), yet other studies had results that were not statistically significant for affect in adults (Blanke et al. 2018), drug abuse in adolescents (Calvete et al. 2017), and depression in adolescents (Calvete et al. 2017, 2019; Ciesla et al. 2012). In addition, two experimental studies found that acting with awareness reduced anxiety responses to stressors (Arch and Craske 2010; Bullis et al. 2014). Regarding other dimensions of DM, Ciesla et al. (2012) found that non-judging of experience and non-reactivity to inner experience attenuated the association between stress and depression in adolescents. Furthermore, in Bullis et al.'s (2014) experimental study, the describing dimension attenuated heart rate reactivity, whereas observing increased panic symptoms toward a stressor. Bullis et al. suggested that the effect of the observing dimension could be damaging, and they concluded that only attending to sensations, perceptions, thoughts, and feelings was not necessarily beneficial for the different psychological problems in stressful situations. Along the same lines, previous studies have indicated that observing could have a different role, depending on the meditative ability of the sample (Baer et al. 2008).

The results of several factor analyses indicate that the five DM dimensions are clearly differentiated but related to each other, both in adults (e.g., Baer et al. 2006; de Bruin et al. 2012) and in children and adolescents (Cortazar et al. 2019; Royuela-Colomer and Calvete 2016). Because the dimensions represent different capacities, some authors suggest that it is important to study the interactions between some of these dimensions in order to better understand the relationships between DM and psychological symptoms. In this way, it could help to clarify some of the inconsistent results obtained for some dimensions (e.g., observing). For example, Eisenlohr-Moul et al. (2012) found that high scores in observing protected against some externalizing behaviors such as

Table 1 Summary of the most important findings per facet

Authors	Design and sample	DM facets	Acting with awareness	Non-judging of experience	Non-reactivity to inner experience	Describing	Observing
Arch and Craske 2010	Experimental Adults with anxiety disorders and non-anxious controls		Stress moderation: AA reduces responses to laboratory stressors in clinically anxious and non-anxious samples	NI	NI	NI	NI
Bullis et al. 2014	Experimental Adults		Stress moderation: AA reduces anxious responding to the presented stressors	Stress moderation: not moderate on any outcome variables	NI	Stress moderation: DES reduces heart rate reactivity to stressor	Stress moderation: OBS increased symptoms of panic
Blanke et al. 2018	Longitudinal (9 days) Young adults Outcomes: positive and negative affect (PA; NA) *State mindfulness was measured		Direct effect: not significant	Direct effect: higher PA; less NA	NI	NI	Direct effect: higher PA; less NA
Calvete et al. 2017	Longitudinal (1 year) Adolescents Outcomes: depression, externalizing problems (aggressive behavior and rule-breaking behavior), drug abuse and non-suicidal self-injury (NSSI) for automatic and social reinforcement		Stress moderation: not significant	Stress moderation: NJ buffers the adverse effect of daily hassles on affect	NI	NI	Stress moderation: not significant
Calvete et al. 2019	Longitudinal (2 years) Adolescents Outcomes: depression Longitudinal (1 week) Adolescents Outcomes: depression (dysphoric affect: sadness scale)		Direct effect: not significant for depression, externalizing problems, and drug abuse. Less NSSI for both automatic and social reinforcement Stress moderation: AA attenuated the relation between stress and externalizing problems and NSSI. Not significant for depression and drug abuse	NI	NI	NI	NI
Ciesla et al. 2012	Longitudinal (1 week) Adolescents		Direct effect: less depression Stress moderation: not significant	Direct effect: not significant Stress moderation: NJ attenuates the relation between stress and depression	Direct effect: not significant Stress moderation: NR	NI	NI
Dixon and Overall 2016	Longitudinal (10 days) Adults Outcomes: depression Longitudinal (2 years) University students Outcomes: depression and rumination		Direct effect: less depression Stress moderation: AA attenuates the relation between stress and depression Direct effect: not significant	NI	NI	NI	NI
Petrocchi and Ottaviani 2016	Longitudinal (4 months) Adolescents Outcomes: depression and rumination		Direct effect: less depression	Direct effect: less depression	Direct effect: not significant	Direct effect: not significant	Direct effect: not significant
Royuela-Colomer and Calvete 2016	Longitudinal (4 months) Adolescents Outcomes: depression and rumination		Direct effect: less depression	Direct effect: not significant	Direct effect: less depression	Direct effect: not significant	Direct effect: higher rumination. Not significant for depression

AA, acting with awareness; NJ, non-judging of experience; NR, non-reactivity to inner experience; DES, describing; OBS, observing; NI, not included in the study

alcohol and tobacco use, but only when scores of non-reactivity to inner experience were also high. This pattern of results was also found in other studies for internalizing symptoms such as depression (Desrosiers et al. 2014), and measures of physical health (Tomfohr et al. 2014). In the same line, other studies found that acting with awareness was associated with less borderline personality disorder symptomatology, but only at high levels of non-judging of inner experience (Peters et al. 2013; Tomfohr et al. 2014).

Regarding sex differences, albeit with exceptions (see Tan and Martin 2012), several previous studies have found differences in DM scores. For instance, studies have found that boys obtained higher scores in acting with awareness (Calvete et al. 2019), describing, and non-judging (Royuela-Colomer and Calvete 2016), or even in all dimensions except for observing (Bergin and Pakenham 2016). One of the explanations for these sex differences could be the greater frequency in rumination style found in girls, which is negatively associated with DM (Royuela-Colomer and Calvete 2016). These differences in DM raise questions regarding whether there are potential differences according to sex in the concomitant benefits of each dimension. A previous study found that DM moderated the association between stress and symptoms only in boys (Calvete et al. 2019), but this study only assessed the dimension of acting with awareness, so it would be important to explore sex differences in the protective role of other dimensions of DM as well. This would help interventions adapt better in accordance with whether they are aimed at boys or girls. With regard to age differences, some studies have found that age correlates negatively with acting with awareness (e.g., Calvete et al. 2019; de Bruin et al. 2014), whereas other studies have found positive correlations (Bergin and Pakenham 2016). With respect to the other dimensions of mindfulness, some studies have found that age associates positively with non-reactivity (Ciesla et al. 2012), describing, and non-judging (Bergin and Pakenham 2016).

The first aim of the current study was to identify which dimensions of the DM predict a reduction in internalizing and externalizing psychological problems over time among adolescents, and especially in concurrence with stressful circumstances. In keeping with the findings of previous studies, except for observing, all dimensions of mindfulness were expected to predict fewer symptoms over time (both externalizing and internalizing). It was also expected that DM dimensions would reduce the association between stressors and psychological symptoms. The second aim was to examine the interplay between some dimensions of DM in predicting changes in psychological problems. It was expected that observing would be associated with fewer psychological problems when non-reactivity or non-judging is high. Furthermore, it was also expected that non-judging would be associated with fewer psychological problems, particularly in concurrence with high awareness. Figure 1 displays the

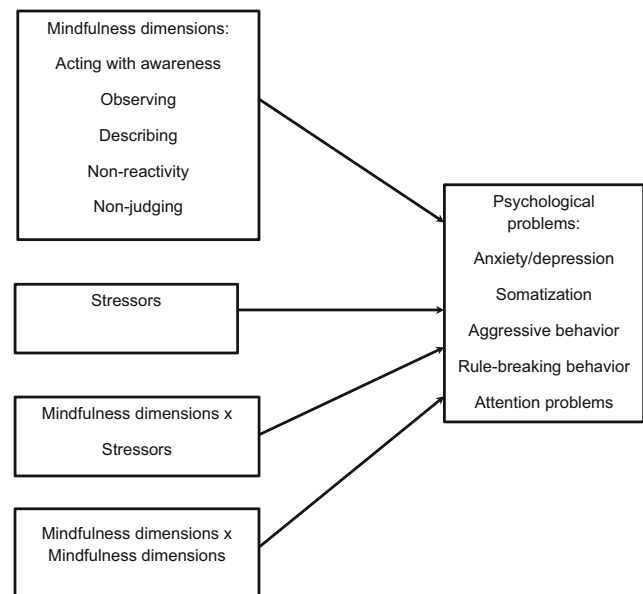


Fig. 1 Conceptual model

conceptual model of the study. We also examined whether the predictive models of the DM, stressors, and psychological symptoms were similar for boys and girls. Finally, as this study includes a broad range of ages (12–18 years), age was included in the models in order to control its association with the variables of the study.

Method

Participants

The initial sample consisted of 872 adolescents aged between 12 and 18 years old. From the initial sample, 737 adolescents (377 girls, 51.2% girls) completed the measures in the two waves of the study (permanence rate = 84.52%). The mean age was 14.35 years ($SD = 1.57$). All participants were pupils at six schools in Araba and Bizkaia (Spain) and participated in the study voluntarily with the consent of their parents or legal guardians. The criterion recommended by the Spanish Society of Epidemiology (2000) was used to calculate the socioeconomic level of their families, with the following results: 13.6% low, 16% low–medium, 30.6% medium, 14.8% high–medium, and 25% high.

Procedure

The schools were selected randomly and the administrators were informed about the goals of the study. Once the schools' approval had been obtained, the children's parents or legal guardians were notified and given the option to decide whether their children could participate by providing informed consent. Only 10 parents (1.26%) refused to give consent. The

participants were informed that the study aimed to examine the importance of DM in youths when coping with stressors. The participants were told about the voluntary nature of taking part in the study and how their answers would be kept anonymous. All of the recruited participants agreed to take part and completed the questionnaires in the classroom during the two waves of the study (6 months apart) in the presence of a researcher. The researcher encouraged the participants to voice any doubts to ensure a better understanding of the questions. The questionnaires took between approximately 40 and 60 min to complete. Preacher and Coffman's (2006) calculator was used in order to do a power analysis. For the test of exact fit, the required sample size for a power of 99% and an alpha value of .01 is 294, and the power in the present study was 100%. The Ethics Committee of the University of Deusto approved this study.

Measures

The Five Facet Mindfulness Questionnaire (FFMQ; Baer et al. 2006) The FFMQ is a self-administered questionnaire that measures the five facets of mindfulness through 39 items, which were answered on a Likert scale from 1 (*never or rarely true*) to 5 (*very often or always true*). The facets include the following: observing (composed of eight items, e.g., "I pay attention to sounds, such as clocks ticking, birds chirping, or cars passing"), describing (composed of eight items, e.g., "I can easily put my beliefs, opinions, and expectations into words"), non-judging of inner experience (composed of eight items, e.g., reverse-scoring item: "I criticize myself for having irrational or inappropriate emotions"), acting with awareness (composed of eight items, e.g., reverse-scoring item: "When I do things, my mind wanders off and I'm easily distracted"), and non-reactivity to inner experience (composed of seven items, e.g., "I perceive my feelings and emotions without having to react to them"). The Spanish version of the FFMQ adapted to adolescents (FFMQ-A; Royuela-Colomer and Calvete 2016) was used to conduct the present study, in which the wording of some items was adapted to youth in order to facilitate the understanding of the contents. Recently, the measurement model of the FFMQ has been extensively examined in samples of children and adolescents ranging between 10 and 18 years (Cortazar et al. 2019). The results indicated that the fit of the model was adequate both in younger and older participants, although it was slightly better for older participants. The test of invariance indicated partial invariance across grades, with slight differences in the non-judging facet. In this study, Cronbach's α coefficients were as follows: observing = .68, describing = .72, non-judging = .80, acting with awareness = .79, and non-reactivity = .58.

Youth Self-Report (YSR; Achenbach and Rescorla 2001) The YSR is a self-administered questionnaire that measures different internalizing and externalizing symptoms through 113 items, which are answered on a scale of 0 (*not true in the last 6 months*) to 2 (*very often or often true in the last 6 months*). This study used an adaptation of the YSR in Spanish (Sandoval Mena et al. 2006). Five subscales were used: somatic complaints (composed of 10 items, e.g., "I feel too tired"), anxious/depressed (composed of 13 items, e.g., "I worry a lot"), attention problems (composed of nine items, e.g., "I cannot concentrate or pay attention for long"), aggressive behavior (composed of 17 items, e.g., "I tease other people a lot"), and rule-breaking behavior (composed of 15 items, e.g., "I do not feel guilty after misbehaving"). In the present study, Cronbach's α coefficients at time 1 (T1) were as follows: somatic complaints = .72, anxious/depressed = .78, attention problems = .78, aggressive behavior = .81, and rule-breaking behavior = .74. Cronbach's α coefficients at time 2 (T2) were as follows: somatic complaints = .76, anxious/depressed = .80, attention problems = .82, aggressive behavior = .84, and rule-breaking behavior = .79.

Adolescent Life Events Questionnaire (ALEQ; Hankin and Abramson 2002) The ALEQ is a self-administered questionnaire that measures a wide range of frequent negative events in adolescence through 70 items. For the present study, an adaptation of the ALEQ was used in Spanish (Calvete et al. 2014) that included the 31 most relevant items to Spanish children and adolescents. When completing the ALEQ, participants have to indicate whether each of the events happened or not, and if so, had to indicate the degree of stress they felt. However, for this study, the number of stressors was used as the indicator of stressors because the measures obtained from evaluating the degree of experienced stress can easily be contaminated by distress symptoms (Dohrenwend 2006). All participants had experienced at least one stressor. Example items include the following: "Have few or no friends," "Problems or arguments with teachers or the headmaster," "Breaking up with or being rejected by your partner," or "You have disappointed your parents."

Data Analyses

Path analysis was used with LISREL 9.2 with the robust maximum likelihood (RML) method, which requires an estimate of the asymptotic covariance matrix of the sample variances and covariances, and includes the Satorra-Bentler scaled χ^2 index (S-B χ^2). The application developed by Crawford and Henry (2003) based on the procedure proposed by Satorra and Bentler (2001) to compare between models was employed. The hypothesized model included autoregressive paths from

the measures at T1 to the same measures at T2 (psychological problems: anxious/depressed, somatic complaints, rule-breaking behavior, aggressive behavior, and attention problems), and cross-lagged predictive paths from T1 stressors and T1 DM dimensions (observing, describing, acting with awareness, non-judging of inner experience, and non-reactivity to inner experience) to psychological problems at T2. The model also included paths from the interaction terms among the five dimensions of DM and stressors (observing \times stressors, describing \times stressors, acting with awareness \times stressors, non-judging of inner experience \times stressors, and non-reactivity to inner experience \times stressors), and from the interaction terms among dimensions of DM (i.e., non-judging of inner experience \times acting with awareness, observing \times non-reactivity to inner experience, and observing \times non-judging of inner experience) to psychological problems at T2. All the variables were transformed at T1 into z scores following the standard procedure to examine moderation effects. Interaction plots were carried out by means of a macro by Dawson (2018). Finally, age was included in the model to control for covariance between age and the rest of the variables.

The goodness of fit model was evaluated using the comparative fit index (CFI), the non-normative fit index (NNFI), and the root mean square error of approximation (RMSEA). Generally, CFI and NNFI values of .90 or higher reflect a good fit. RMSEA values lower than .06 indicate an excellent fit (Hu and Bentler 1999). All data are available at the Open Science Framework (<https://osf.io/768jf/>).

Results

Descriptive Statistics and Sex Differences

Table 2 presents the descriptive statistics and correlation coefficients between all the variables. It also presents their means and standard deviations. Stressors were positively associated with all psychological problems. The five dimensions of mindfulness were negatively associated with psychological problems at T1 and T2 in general. Table 3 presents sex differences for all the variables of the study and the percentage of adolescents with scores in the YSR indicative of clinical problems at T1 and T2. The most frequent problems were somatic complaints and rule-breaking behaviors. Furthermore, girls had higher scores on anxious/depressed symptoms and somatic complaints in both T1 and T2. Boys had higher scores on stressors at T1 and on rule-breaking behavior at T2. There were no differences between girls and boys on mindfulness dimensions. The effect sizes were small for all of the variables included in this study, except for anxiety/depression which was found to be medium.

Predictive Model

The predictive model via path analysis obtained adequate Satorra–Bentler fit indexes $\chi^2(147, N = 737) = 470$, RMSEA = .054 (90% CI [.049–.060]), NNFI = .940, CFI = .971. The model explained the 36%, 29%, 50%, 50%, and 45% of the variance, respectively, of anxiety/depression, somatic complaints, attention problems, rule-breaking behavior, and aggressive behavior at T2. Table 2 displays the cross-sectional paths between variables of the model: stress was positively associated with all psychological symptoms; acting with awareness and non-judging were negatively associated with all psychological symptoms; describing was negatively associated with anxiety/depression, somatic complaints, and attention problems; observing was positively associated with anxiety/depression and somatic complaints; and age was positively associated with stress, observing, and all psychological symptoms except somatic complaints, and negatively associated with acting with awareness.

At the longitudinal level, the autoregressive paths for anxious/depressed (.55), somatic complaints (.45), rule-breaking behavior (.60), aggressive behavior (.59), and attention problems (.51) were statistically significant ($p < .001$), indicating the stability of these variables over the 6-month follow-up. Table 4 displays the regressive coefficients of the model: stressors predicted an increase in somatic complaints, rule-breaking behavior, and attention problems over time; acting with awareness predicted lower scores on all psychological problems over time; observing predicted lower externalizing symptoms (rule-breaking and aggressive behavior) over time; and describing predicted lower scores on attention problems over time, but non-judging of inner experience predicted an increase of attention problems and rule-breaking behavior. In addition, three interaction terms among DM and stressors predicted changes in psychological problems: the observing \times stressors interaction term predicted changes in internalizing problems (anxiety/depression and somatic complaints) and in rule-breaking behavior at T2; the describing \times stressors interaction term predicted changes in internalizing problems (anxiety/depression and somatic complaints) and aggressive behavior at T2; and the non-judging of inner experience \times stressors interaction term predicted changes in somatic complaints at T2. All the forms of the significant interactions are displayed in several figures. Figure 2a displays the predictive association between T1 stressors and T2 anxiety/depression for adolescents that scored low ($z = -1$) and high ($z = 1$) on the describing dimension of DM. As observed, the association between stressors and anxiety/depression was lower among adolescents that scored high on describing. The describing \times stress interaction was not plotted for somatic complaints and aggressive behavior because the form of the interaction was similar. Figure 2b displays the predictive association between T1 stressors and T2 somatic complaints for adolescents that scored low ($z = -1$) and high ($z = 1$) for the observing dimension of

Table 2 Correlations and cross-sectional covariance coefficients between variables and descriptive statistics

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1. T1 Obs		.24**	.06	-.02	.44**	.00	.08*	.07*	.00	-.01	.06	.08*					
2. T1 Des	.24**		.29**	.28**	.34**	-.06	-.18**	-.09*	-.14**	-.05	-.06	-.01					
3. T1 ActAware	.06	.29**		.44**	.14**	-.20**	-.25**	-.17**	-.60**	-.34**	-.35**	-.26**					
4. T1 NJ	-.02	.28**	.44**		.07	-.15**	-.37**	-.18**	-.20**	-.16**	-.17**	-.03					
5. T1 NR	.44**	.34**	.14**	-.07		-.00	-.06	.01	.07	.02	.00	.01					
6. T1 Stressors	.00	-.06	-.21**	-.15**	-.00		.31**	.28**	.35**	.34**	.41**	.17**					
7. T1 Anx/Dep	.08*	-.18**	-.25**	-.37**	-.06	.31**		.52**	.40**	.25**	.47**	.13**					
8. T1 Somat	.07	-.09*	-.17**	-.18**	-.01	.28**	.52**		.30**	.22**	.35**	.04					
9. T1 AttentionP	.00	-.14**	-.60**	-.20**	-.07	.35**	.40**	.30**		.54**	.60**	.36**					
10. T1 RB	.01	-.05	-.34**	-.16**	.02	.34**	.25**	.22**	.54**		.66**	.39**					
11. T1 Aggres	.06	-.06	-.35**	-.17**	.00	.41**	.47**	.35**	.60**	.66**		.30**					
12. Age	.08*	-.01	-.26**	-.03	.01	.17**	.13**	.04	.36**	.39**	.30**						
13. T2 Anx/Dep	.02	-.15**	-.22**	-.25**	-.04	.19**	.61**	.32**	.30**	.16**	.32**	.15**					
14. T2 Somat	.00	-.12**	-.18**	-.14**	-.05	.23**	.39**	.50**	.26**	.18**	.25**	.10**	.56**				
15. T2 AttentionP	-.03	-.18**	-.53**	-.14**	-.08*	.28**	.29**	.21**	.69**	.45**	.48**	.35**	.42**	.36**			
16. T2 RB	-.07	-.05	-.34**	-.09*	-.01	.30**	.13**	.14**	.45**	.71**	.54**	.35**	.24**	.28**	.52**		
17. T2 Aggres	-.05	-.09*	-.32**	-.13**	-.08*	.31**	.32**	.23**	.48**	.53**	.69**	.27**	.48**	.38**	.59**	.70**	
Mean	3.13	3.21	3.31	3.46	2.90	13.60	6.02	3.29	5.79	4.22	6.41	14.35	6.13	3.44	6.18	4.65	6.86
SD	0.69	0.63	0.69	0.73	0.58	6.98	4.08	2.67	3.54	3.59	4.55	1.57	4.42	3.09	3.91	4.03	5.07
Skewness	-.012	-.018	-.020	-.034	0.30	0.49	0.90	1.00	0.46	1.21	0.90	-0.09	0.83	1.15	0.40	1.15	0.74
Kurtosis	-.020	0.29	0.32	0.22	1.20	-0.08	0.75	1.05	-0.32	1.86	1.08	-0.99	0.43	1.23	-0.43	1.03	0.13

$n = 737$. Obs, observing; Des, describing; ActAware, acting with awareness; NJ, non-judging; NR, non-reactivity; Anx/Dep, anxious/depression; Somat, somatic complaints; AttentionP, attention problems; RB, rule-breaking behavior; Aggres, aggressive behavior. * $p < .05$; ** $p < .01$. Values over the diagonal represent the cross-sectional covariance coefficients obtained in the path analysis

Table 3 Sex differences in all study variables and clinical cases in psychological problems

	Girls (<i>n</i> = 377)		Boys (<i>n</i> = 360)		<i>t</i>	<i>p</i>	Cohen's <i>d</i>	Clinical cases (%)
	Mean	SD	Mean	SD				
T1 observing	3.16	0.68	3.11	0.69	1.07	.-	287	0.08
T1 describing	3.17	0.67	3.24	0.58	- 1.48	.-	140	- 0.11
T1 acting with awareness	3.32	0.71	3.30	0.67	0.39	.-	697	0.03
T1 non-judging	3.45	0.77	3.45	0.68	0.42	.-	677	0.03
T1 non-reactivity	2.87	0.56	2.93	0.59	- 1.52	.-	128	- 0.11
T1 stressors	13.09	6.35	14.13	7.56	- 2.03	.-	043	- 0.15
T1 anxious/depression	6.89	4.22	5.12	3.72	6.06	.-	000	0.45
0.95 T1 somatic complaints	3.59	2.77	2.97	2.53	3.15	.-	002	0.67
9.8 T1 attention problems	5.69	3.64	5.89	3.44	- 0.77	.-	440	- 0.06
5 T1 rule-breaking behavior	4.13	3.58	4.33	3.60	- 0.74	.-	461	- 0.05
12.9 T1 aggressive behavior	6.36	4.55	6.47	4.56	- 0.33	.-	740	- 0.02
1.2 T2 anxious/depression	7.10	4.69	5.12	3.87	6.27	.-	000	0.46
0.95 T2 somatic complaints	3.81	3.15	3.06	2.98	3.33	.-	001	0.25
12.3 T2 attention problems	6.12	3.94	6.24	3.88	- 0.40	.-	692	- 0.03
6.9 T2 rule-breaking behavior	4.32	3.87	4.99	4.17	- 2.27	.-	023	- 0.17
17.5 T2 aggressive behavior	7.02	4.90	6.69	5.24	0.87	.-	382	0.06
2								

DM. The findings indicate that when observing was high, the predictive association between stress and somatic complaints was higher as well. The observing \times stress interaction was not

plotted for anxiety/depression and rule-breaking behavior because the form on the interaction was similar. Figure 2c displays the predictive association between T1 stressors and T2 somatic

Table 4 Longitudinal paths obtained in the path analysis

Outcome	T2 anxiety/ depression		T2 somatic complaints		T2 attention problems		T2 rule-breaking behavior		T2 aggressive behavior	
	<i>B</i> (SE)	<i>p</i>	<i>B</i> (SE)	<i>p</i>	<i>B</i> (SE)	<i>p</i>	<i>B</i> (SE)	<i>p</i>	<i>B</i> (SE)	<i>p</i>
T1 observing	− 0.15 (0.16)	.33	− 0.04(0.12)	.77	− 0.03(0.12)	.78	− 0.33(0.12)	< .01	− 0.36(0.15)	.02
T1 describing	− 0.16(0.15)	.30	− 0.15(0.11)	.17	− 0.25(0.12)	.03	0.08(0.11)	.49	0.03(0.17)	.84
T1 acting with awareness	− 0.36(0.15)	.01	− 0.25(0.11)	.02	− 0.92(0.13)	< .01	− 0.67(0.13)	< .01	− 0.59(0.17)	< .01
T1 non-judging	− 0.08(0.15)	.59	− 0.05(0.11)	.68	0.33(0.12)	< .01	0.27(0.11)	.02	0.09(0.16)	.59
T1 non-reactivity	0.11(0.15)	.48	− 0.08(0.10)	.45	0.01(0.12)	.95	0.09(0.12)	.47	− 0.187(0.16)	.28
T1 stress	0.01 (0.13)	.96	0.25(0.11)	.02	0.24(0.11)	.03	0.30(0.11)	< .01	0.26(0.15)	.07
Observing × stress	0.28(0.13)	.03	0.24(0.10)	.02	0.20(0.11)	.06	0.19(0.10)	.05	0.06(0.16)	.70
Describing × stress	− 0.40(0.13)	< .01	− 0.21(0.10)	.03	− 0.06(0.10)	.51	− 0.14(0.10)	.14	− 0.35(0.15)	< .01
Acting with awareness × stress	0.06(0.14)	.67	0.04(0.12)	.77	− 0.03(0.10)	.75	0.03(0.13)	.82	0.08(0.17)	.62
Non-judging × stress	− 0.07(0.14)	.61	− 0.26(0.12)	.03	0.14(0.11)	.20	0.01(0.12)	.95	− 0.07(0.16)	.66
Non-reactivity × stress	0.02(0.14)	.87	0.08(0.10)	.44	− 0.09(0.11)	.44	0.14(0.12)	.24	− 0.02(0.15)	.88
Non-judging × ActAware	− 0.20(0.08)	< .01	− 0.15(0.06)	.01	− 0.02(0.06)	.76	− 0.16(0.07)	.02	− 0.22(0.08)	< .01
Observing × non-reactivity	0.03(0.10)	.73	− 0.00(0.08)	.98	− 0.06(0.07)	.41	− 0.05(0.08)	.56	0.09(0.12)	.45
Observing × non-judging	− 0.04(0.09)	.65	− 0.01(0.07)	.88	− 0.14(0.07)	.06	0.03(0.07)	.73	0.04(0.10)	.69

complaints for adolescents that scored low ($z = -1$) and high ($z = 1$) for the dimension of non-judging of inner experience. The findings indicate that when non-judging of inner experience was low, the predictive association between stress and somatic complaints was higher.

Finally, the model indicated that one interaction term among dimensions of DM predicted changes in psychological problems. The non-judging of inner experience × acting with awareness interaction term predicted changes in both internalizing and externalizing problems at T2 (i.e., anxiety/depression and somatic complaints; and rule-breaking behavior and aggressive behavior). Figure 3 displays the predictive association between T1 non-judging of inner experience and T2 anxiety/depression for adolescents that scored low ($z = -1$) and high ($z = 1$) on the dimension of acting with awareness. The findings indicate that non-judging of inner experience predicts less anxiety/depression only when acting with high levels of awareness. The acting with awareness × non-judging of inner experience interaction was not plotted for somatic complaints, rule-breaking behavior, and aggressive behavior because the form of the interaction was similar.

Sex Differences for the Predictive Model

To examine whether the predictive model was variant for sex, the model was estimated separately for boys and girls,

obtaining adequate Satorra–Bentler fit indexes for boys $\chi^2(147, N = 360) = 371$, RMSEA = .065 (90% CI[.057–.073]), NNFI = .911, CFI = .957; and girls $\chi^2(147, N = 377) = 301$, RMSEA = .053 (90% CI[.044–.061]), NNFI = .952, CFI = .977.

The configural invariance of the model was also tested to demonstrate that the pattern of fixed and free parameters was equivalent across subsamples. This model displayed good Satorra–Bentler fit indexes $\chi^2(294, N = 737) = 677$, RMSEA = .06 (90% CI[.054–.065]), NNFI = .933, CFI = .967. Furthermore, a model was estimated in which longitudinal paths were constricted to be equal across both subsamples. This imposition did not increase χ^2 significantly, Satorra–Bentler: $\Delta \chi^2(75, N = 737) = 79, p = .33$. Therefore, it was assumed that the general pattern of associations was similar for boys and girls. However, the modification indexes provided by LISREL indicated that one path should be considered different in boys and in girls. The autoregressive path from T1 to T2 anxiety/depression was significantly higher in girls than in boys [0.65(0.05) vs 0.45 (0.05); $p = .006$].

Discussion

Exposure to stress is an important risk factor for the development of several psychological problems in adolescents (Kim

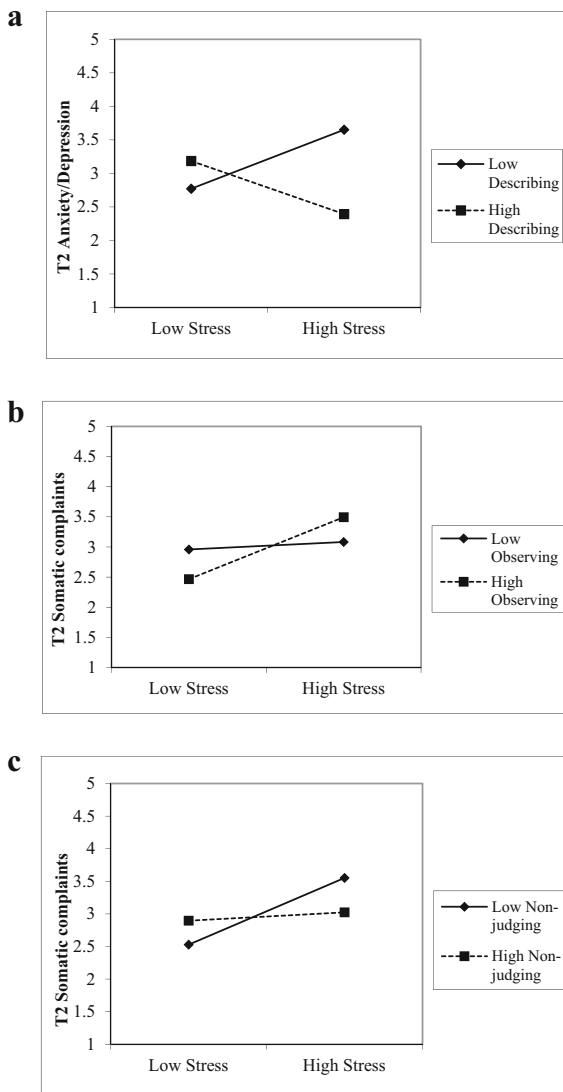


Fig. 2 Stressors × DM interaction and psychological symptoms

et al. 2003; Rudolph et al. 2000). The present study focused on a multidimensional conceptualization of DM as a potential moderator of the impact of stress on internalizing and externalizing problems. Although on the pretest the dimensions of mindfulness were generally associated with fewer internalizing and externalizing symptoms, which is consistent with

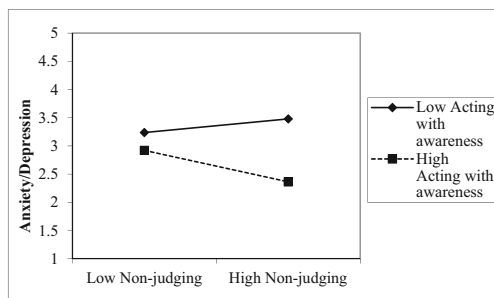


Fig. 3 Interaction among acting with awareness and non-judging for anxiety/depression

previous studies (Bergin and Pakenham 2016; Marks et al. 2010), the longitudinal results indicated that only the dimensions of acting with awareness, observing, and describing predicted fewer psychological problems over time. More specifically, acting with awareness predicted fewer symptoms for all of the psychological problems included in the study, observing predicted fewer externalizing symptoms, and describing predicted fewer attention problems. Additionally, the dimensions of observing, describing, and non-judging interacted with stress, which suggests that their role can depend on the occurrence of stressors.

The results for acting with awareness confirm its beneficial role in the psychological adjustment of adolescents and indicate that this beneficial role occurs regardless of the occurrence of stressors. Although several previous studies have found similar results for acting with awareness and depressive symptoms (Calvete et al. 2019; Ciesla et al. 2012), the present study extends these findings, as results indicate that acting with awareness predicts lower levels of several other internalizing and externalizing problems, and thus this dimension arguably plays a relevant role for psychological adjustment in adolescents. This is also consistent with the theoretical proposal that present-centered attention/awareness is foundational to DM (Brown and Ryan 2003).

As in other previous studies (Petrocchi and Ottaviani 2016; Royuela-Colomer and Calvete 2016), describing was not directly associated with a reduction in psychological problems over time, except with attention problems. However, describing buffered the relationship between stress and depression/anxiety, somatic complaints, and aggressive behavior, indicating an interaction between describing and stress. This result, together with the findings of other studies (Bergin and Pakenham 2016; Bullis et al. 2014), suggests that the capacity to describe internal emotional and cognitive states might be beneficial precisely when adolescents are exposed to high stress and their emotional states are more intense. In fact, the capacity to describe inner states has been found to be related to reduced experiential avoidance of distressing experiences and increased concrete thinking (Desrosiers et al. 2013). Moreover, according to Bergin and Pakenham (2016), the ability to describe events and label internal experiences with words facilitates communication, which in turn enables social support and effective problem solving in stressful situations.

Similar to previous studies (Petrocchi and Ottaviani 2016; Royuela-Colomer and Calvete 2016), in the present study, observing did not predict fewer internalizing symptoms over time, but it was found to exacerbate the negative impact of stress on internalizing symptoms, indicating an interaction between these variables. This could be due to an excessive focus on the negative sensations and stimuli that are concomitant to stress. Furthermore, this interpretation would be coherent with the association between observing and ruminative responses (Royuela-Colomer and Calvete 2016), which acts as a

vulnerability factor for several psychological problems (Aldao et al. 2010). However, observing was found to predict fewer externalizing problems over time. It is not an easy matter to explain these results. Although scarce attention has been given to the longitudinal relationship between observing and externalizing problems, these results could be explained through other concepts, such as empathy. It seems that having a greater capacity to attend to one's own sensations, perceptions, thoughts, and feelings could also be related to empathizing with other people better (Jones et al. 2016), and that empathy might contribute to less implication in proactive aggressive behavior and rule-breaking behaviors of social norms (Euler et al. 2017). Future studies should replicate these findings and look in greater depth at the role of the observing dimension.

The findings for non-judging indicated that, when stress levels are high, increased non-judging seems to protect from some symptoms such as somatization. Furthermore, in line with other studies (Peters et al. 2013; Tomfohr et al. 2014), these capacities to refrain from judging emotions, feelings, and thoughts seem to be beneficial only when adolescents act with awareness. Thus, acting with awareness not only predicts lower levels of the majority of the psychological problems examined in this study, but it also increases the beneficial role of other dimensions of DM. In addition, non-judging predicted an increase in attention problems and rule-breaking over time. These results are consistent with the aforementioned study by Jones et al. (2016), where non-judging predicted lower levels of empathy and active listening that can contribute to less proactive aggression and attention difficulties. Because non-judging partly implies a lack of negative self-evaluation, this would also be consistent with the enhanced self-view that is often presented by adolescents with disruptive behavioral problems (Calvete 2008; Kauten and Barry 2014). Finally, the study did not obtain significant longitudinal relations for non-reactivity. This relative lack of results may have been due to the low internal consistency of this subscale in the present study.

In regard to the differences according to sex, none were found in terms of the dimensions of DM, which differs from the findings of previous studies such as Bergin and Pakenham (2016) and Calvete et al. (2019), but concurred with the findings of Tan and Martin (2012). In addition, the model did not vary for boys and girls, indicating that the general pattern of associations is similar for both boys and girls, except in the stability of anxiety/depression over time which was higher among girls. The latter is consistent with the greater tendency for girls to experience this kind of internalizing problem over time (Li et al. 2006).

Finally, with respect to age, this study found a positive association between age and observing, and negative association between age and acting with awareness, as did other previous studies with adolescents (Calvete et al. 2019; de Bruin et al. 2014). This suggests that in the age range between 12 and 18 years old, there is an increasing tendency to act on

automatic pilot. Similar to personality traits, DM dimensions could change over time, especially among adolescents (Cortazar et al. 2019). No changes were observed regarding age for the other dimensions.

Limitations and Future Research

This study has some limitations that offer opportunities for future research. First, it only included two waves and it would be important to conduct studies with additional follow-ups over time to test whether the associations between the variables are maintained. Second, only self-report measures were used which may increase the association between variables. It would be valuable to include other sources of information, such as parental and peer-reports, in future studies. Third, the participants were not asked about whether they attended mindfulness-based interventions, although according to the participating schools, no mindfulness training had been implemented as of the date of the study. Fourth, although the FFMQ-A has been used in previous studies with the same age range as the present study, Cortazar et al. (2019) concluded that a few items could be difficult to understand for the youngest adolescents. Fifth, only a few potential interactions were examined between DM dimensions to clarify the mixed results obtained for them in previous research, but all the possible interactions were not explored because the model would have been too complex. However, future studies should continue examining the interplay between DM dimensions to further understand the way in which they contribute to psychological adjustment. Finally, the low internal consistency for the non-reactivity subscale in this study may have influenced the results obtained with respect to this dimension of DM. Other studies have also found low internal consistency for this dimension even in adult samples (e.g., Sugiura et al. 2011; Tran et al. 2013). Thus, future research should improve the assessment of this dimension.

Despite these limitations, this study does have its strengths. To begin with, it was conducted with a large sample of adolescents and included two measurement waves, which expands on the previous research that was fundamentally cross-sectional. The study is also based on a multidimensional concept of mindfulness which provides specific information for each dimension. Moreover, most studies conducted to date have only focused on internalizing problems, such as anxiety and depression, and have ignored many psychological problems that are of relevance to adolescents.

In conclusion, this study shows that acting with awareness predicts fewer internalizing and externalizing problems over time in adolescents. In contrast, the role of other dimensions seems to be different for externalizing and internalizing problems. Likewise, some of the dimensions of DM (i.e., observing, non-judging, and describing) attenuate the relationship between stress and psychological problems. More specifically, the describing dimension protects adolescents from the

negative consequences of stress, whereas the observing dimension tends to play a damaging role. It is also important to note that the dimensions do not act in isolation, but some can enhance the action of other DM dimensions, and in particular, acting with awareness enhances the beneficial effect of non-judging inner experience.

Recent meta-analyses have found that mindfulness training seems to produce changes in dimensions of self-reported DM, and that these dimensions seem to be associated with other beneficial changes (Quaglia et al. 2016), such as the reduction of psychological symptoms in youth (Zoogman et al. 2014). As a whole, findings of the current study inform of the development of mindfulness-based interventions for adolescents. If results of this study are confirmed in other studies, future intervention research could include techniques to improve the capacity to act with awareness, and techniques aimed at enhancing other dimensions should be conditioned by the nature of the psychological problems that each particular intervention is targeting. In addition, there is also evidence that mindful parenting is effective on a broad range of family factors such as child psychopathology (Bögels et al. 2013), and this can serve to improve DM in youth (Moreira et al. 2018). Therefore, interventions aimed at parents and even teachers could benefit the development of DM in adolescents.

Author Contributions NC: collaborated with the design of the study, analyzed the data, wrote the paper, prepared the tables, and revised the references. EC: designed the study, collaborated with the writing of the study, analyzed the data, and wrote part of the results. All authors approved the final version of the manuscript for submission.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest.

Ethical Standards The procedures of this study have been approved by the institutional research committee of the University of Deusto and have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Informed Consent Informed consent was obtained from all individual participants included in the study and their parents/guardians.

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