

**Title:** Mindfulness, mood symptom tendencies and quality of life in bipolar disorder: An examination of the mediating influence of emotion regulation difficulties.

**Running Title:** Mindfulness, emotion regulation and bipolar

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## Abstract

*Background:* The aim of this cross-sectional study was to investigate dispositional mindfulness and its association with depression and manic tendencies, and subjective life quality in bipolar disorder (BD). Furthermore, this study sought to examine the potential mediating effects of emotion regulation difficulties on these relationships.

*Method:* Twenty-eight healthy controls (HC) and 66 clinically stable outpatients with a DSM-IV-TR diagnosis of BD completed the Mindfulness Attention Awareness Scale (MAAS), Difficulties in Emotion Regulation Scale (DERS), Seven Up (7 Up) Seven Down (7 Down) and the Quality of Life in Bipolar Disorder Questionnaire (QoL.BD). These variables were compared between groups and entered into a series of mediation analyses using PROCESS in the BD group only.

*Results:* Lower MAAS scores were detected amongst the BD patients compared to HCs. Lower MAAS scores in BD patients predicted higher 7 Up, 7 Down and lower QoL.BD scores. For the 7 Down and QoL.BD, the associations were completely mediated by DERS scores, with difficulties in strategy use and emotional clarity mediating the association between mindfulness and depressive tendencies and quality of life, respectively. No significant direct or indirect effects were detected for the 7 Up model.

*Limitations:* The cross-sectional design precludes causal inference. The MAAS conceptualises mindfulness as unidimensional. Self-report scales of depressive and manic tendencies utilised.

*Conclusions:* This study detected a significant association between dispositional mindfulness and depressive tendencies and life quality in BD, and found that these associations were influenced by emotion regulation difficulties. These findings encourage further investigation of mindfulness-based interventions in BD.

Despite widespread use of conventional pharmacological treatments, episodic relapse after mood stabilisation in bipolar disorder (BD) is common (Gitlin et al., 1995). Key risk factors for relapse and poor clinical course in BD include trait depressive tendencies, comorbid anxiety, and the presence of residual mood symptoms during inter-episode periods (Altman et al., 2006; Brietzke et al., 2012; Judd et al., 2008; Lozano and Johnson, 2001; Samalin et al., 2016; Treuer and Tohen, 2010). At the same time, these emotion-relevant symptoms contribute to the persistent psychosocial dysfunction that is characteristic of a large proportion of individuals with the disorder (Van Rheenen and Rossell, 2014a, b).

One psychological factor implicated as a protective mechanism against maladaptive mood symptoms is mindfulness (Radford et al., 2014). Mindfulness refers to both an enduring dispositional tendency as well as a meditative practice that facilitates a disengagement from automatic thoughts, habits, and unhealthy behavioural patterns (Brown and Ryan, 2003). Being mindful, therefore, involves paying purposeful attention to present moment experiences with a curious, non-judgemental and accepting attitude (Hölzel et al., 2011; Kabat-Zinn, 2009; Ludwig and Kabat-Zinn, 2008). Since greater dispositional mindfulness optimises self-regulatory processes important for psychological well-being, it has been linked to a range of emotional health-related benefits. These include, but are not limited to, increased mental flexibility and resilience, reduced maladaptive ruminations and mind-wandering, as well as lower levels of impulsivity, stress and anxiety (Becerra et al., 2017; Chambers et al., 2009; Chiesa and Serretti, 2009; Davis and Hayes, 2011; Grossman et al., 2004; Keng et al., 2011).

Mindfulness practices have been incorporated into formal psychological therapies since the 1980s, with mindfulness-based interventions grounded on the premise that distress is a result of an individual's response to an experience or symptom rather than the event itself (Abba et al., 2008; Hayes, 2004; Kabat-Zinn, 1982; Kabat-Zinn, 2009; Louise et al., 2018;

Phang and Oei, 2012). Thus, mindfulness training in its essence, teaches observation and acceptance of all experiences, as opposed to directly reacting to, challenging, or ruminating on these experiences (Murray et al., 2017). There is evidence that suggests individuals with higher dispositional mindfulness have better outcomes from mindfulness training compared to individuals with lower dispositional mindfulness (Shapiro et al., 2011). To our knowledge, dispositional mindfulness has not been explicitly assessed in BD, although mindfulness-based interventions are being increasingly trialled in the disorder. Whilst these interventions appear to have minimal effect on manic symptoms, significant improvements in sub-clinical depression and anxiety, psychological well-being and psychosocial functioning have been reported amongst euthymic BD individuals (Bojic and Becerra, 2017; Chu et al., 2018; Lovas and Schuman-Olivier, 2018; Murray et al., 2017). However, the mechanisms by which mindfulness benefits people with BD are yet to be established.

One process put forward as a potential mediating factor in the relationship between mindfulness and psychopathology is that of emotion regulation (Chambers et al., 2009; Coffey et al., 2010; Gratz and Tull, 2010; Guendelman et al., 2017). Traditionally, emotion regulation has been defined as a set of automatic and control processes that initiate, maintain, and modify the intensity and duration of emotions (Gross, 1998; 2014). This purportedly occurs through selecting, modifying, or attending to specific components of the emotion-inducing situation/stimulus, altering how the situation/stimulus is perceived mentally, or directly modifying the behavioural response to the emotion. An alternate framework put forward by Gratz and Roemer (2004) posits that emotion regulation also involves the understanding, awareness, and acceptance of emotional distress, rather than only the control or dampening of emotions or emotional arousal. This framework highlights emotion regulation as involving the flexible and goal-directed use of situationally appropriate strategies to modulate the *responses to* emotions, rather than attempts to control emotions for

the purpose of avoiding or eliminating them entirely. Within this, the dimensions of emotion regulation that *recognise* that all emotions serve a purpose, appear to be most relevant to the study of mindfulness, and are likely mediators of mindfulness-based psychological change (Gratz and Tull, 2010). Specifically, the emphasis of mindfulness on the observation and description of one's experiences is theorised to promote emotional awareness, clarity, objectivity, and acceptance of *all* emotions, even those that are unpleasant. It has been argued that this may lead to a decoupling of emotion from behaviour, and thus eventually, less automatic reactions to emotional experiences (Gratz and Tull, 2010). In contrast, control-based conceptualisations of emotion regulation are likely to reinforce a non-accepting and judgemental stance towards unwanted emotions, a process which goes against the principles of mindfulness and mindfulness-based therapies.

Central to the present study is the fact that emotion regulation difficulties are characteristic and enduring features of BD (Dodd et al., 2019; Townsend and Altshuler, 2012). Indeed, patients with the disorder report increased maladaptive coping strategy use compared to controls (Bridi et al., 2018; Fletcher et al., 2013; Green et al., 2011), as well as poorer emotional clarity and difficulties accepting emotional responses or believing in one's own capacity to regulate emotion effectively (Becerra et al., 2013; Van Rheenen et al., 2020; Van Rheenen et al., 2015). Such difficulties have been repeatedly associated with depressive tendencies (Van Rheenen et al., 2020; Van Rheenen et al., 2015).

Several lines of empirical inquiry indicate that emotion regulation mediates the effect that dispositional mindfulness has on various psychopathologies (Coffey and Hartman, 2008; Coffey et al., 2010), and that enhancements to emotion regulation in non-clinical populations arise from formal mindfulness training (Schirda et al., 2020; Wimmer et al., 2019; Zhang et al., 2019). It is thus possible that the effect of mindfulness on indicators of psychopathology in BD occur via its effects on emotion regulation. As such, the aim of the current study was

to explore whether emotion regulation difficulties mediated the relationship between dispositional mindfulness and depressive and manic tendencies in individuals with the disorder, as well as their subjective quality of life. It was hypothesised that individuals with BD would report lower dispositional mindfulness compared to controls. It was also hypothesised that lower levels of dispositional mindfulness in the BD group would be associated with increased depressive tendencies and poorer quality of life; with these associations mediated by the magnitude of emotion regulation difficulties. Finally, given the negligible findings of the mindfulness trial-based literature in relation to mania, a secondary exploratory aim of the current study was to examine whether these associations extended to mania tendencies.

## **Method**

This work complies with the ethical standards of the Local Human Ethics Review Board and with the Declaration of Helsinki.

### *Participants*

Participants included 28 healthy controls (HC;  $n = 16$  female,  $n = 12$  male) and 66 clinically stable outpatients ( $n = 32$  female,  $n = 34$  male) with a DSM-IV-TR BD diagnosis. BD diagnosis and HC status was confirmed using the Mini International Neuropsychiatric Interview (MINI: Sheehan et al., 1998). No BD participant met criteria for a mood episode at the time of assessment, and none reported that they had experienced a mood episode in the three weeks prior. Current mood symptom severity was assessed using the Young Mania Rating Scale (YMRS: Young et al., 1978) and the Montgomery-Åsberg Depression Rating Scale (MADRS: Montgomery and Asberg, 1979), from which 51 BD participants (78%) were considered to be strictly euthymic, as defined by MADRS and YMRS scores of  $\leq 8$ .

Fourteen BD participants (22%) were considered to be symptomatic as they displayed mild-moderate scores on the clinical rating scales (i.e., 11 with MADRS scores  $> 12$  and 3 with YMRS scores  $> 8$ ). YMRS and MADRS data was missing for one participant. Participants were recruited from the community in metropolitan Melbourne, Australia, using print- and online-based advertisements, BD patients were also recruited from community support groups and participant databases held by the senior author. The current study represents a secondary analysis of data previously collected for a larger project, the results of which have been partly reported elsewhere (Lemvigh et al., 2021; Karantonis et al., 2020a; 2020b). The current sample size was therefore based on the availability of participants with complete data for all the materials described below.

Exclusion criteria for the BD group included: known neurological/neurodegenerative disease (i.e., epilepsy, encephalitis or Huntington's disease), a history of severe head injury resulting in loss of consciousness, hearing or visual impairments, pregnancy, a history of habitual drug use or dependence in the three months prior to participation, and significant medication change in the two months prior to study inclusion. Exclusion criteria were the same for the HC group, with the addition of the following conditions: psychiatric illness, a family history of psychiatric disorders, or currently taking psychotropic medication/receiving psychiatric care.

- Insert Table 1 around here –

### *Materials*

*Dispositional mindfulness* was assessed using the Mindfulness Attention Awareness Scale (MAAS; Brown and Ryan, 2003). The MAAS is a 15-item unidimensional self-report assessment of mindfulness measured on a 6-point Likert-type scale ranging from 1 = “*Almost*

*always*” to 6 = “*Almost never*”. Higher scores represent greater dispositional mindfulness. The MAAS is “focused on the presence or absence of attention to and awareness of what is occurring in the present rather than on attributes such as acceptance, trust, empathy, gratitude, or the various others that have been associated with mindfulness” (e.g. “I rush through activities without being really attentive to them”; Brown and Ryan, 2003, p. 824). The MAAS has good internal consistency ( $\alpha = 0.92$ ; current study,  $\alpha = 0.86$ ) and test-retest reliability ( $\rho = .81$ ). The MAAS has documented convergent validity via strong associations with measures of mindfulness-mindlessness, emotional intelligence, and openness to experience, specifically the traits of attentiveness and receptivity to experience rather than fantasy and aesthetics, in addition to limited-to-no associations with private self-consciousness, self-monitoring, reflection and absorption.

*Difficulties in emotion regulation* was assessed using the Difficulties in Emotion Regulation Scale (DERS; Gratz and Roemer, 2004). The DERS is a 36-item self-report assessment of the approach to, understanding, and modulation of emotions measured on a five-point Likert scale ranging from 1 = *Almost never* to 5 = *Almost always*. The DERS is comprised of six subscales reflecting different dimensions of emotional regulation during distress. The five DERS subscales examined in the present study were: *Clarity* — reflecting lack of emotional clarity (e.g. “I have no idea how I am feeling”); *Goals* — reflecting difficulty in engaging in goal-directed behaviours when experiencing negative emotions (e.g. “When I’m upset, I have difficulty getting work done”); *Impulse* — reflecting difficulty controlling impulsive behaviour under negative emotional arousal (e.g. “When I’m upset, I feel out of control”); *Non-acceptance* — reflecting the tendency towards being non-accepting of emotional responses when distressed (e.g. “When I’m upset, I become embarrassed for feeling that way”), and; *Strategies* — reflecting the extent to which one believes they have



access to situationally-appropriate strategies to regulate mood (e.g. “When I’m upset, I believe that there is nothing I can do to make myself feel better”). As a consequence of the documented psychometric issues associated with the *Awareness* subscale of the DERS (Bardeen et al., 2012; Bjureberg et al., 2016), as well as its conceptual overlap with mindfulness, as operationalised using the MAAS, the *Awareness* subscale was not examined in the present study. This is in line with previous research on mindfulness and emotion regulation (e.g. Garofalo et al., 2020; Ma and Fang, 2019). Higher scores on each subscale represent greater difficulties in regulating emotion. The DERS has good documented overall internal consistency ( $\alpha = 0.93$ ), and test-retest reliability ( $\rho = .88$ ). The internal consistency for the subscales in the current study were as follows: *Clarity*,  $\alpha = 0.82$ ; *Impulse*,  $\alpha = 0.88$ ; *Non-acceptance*,  $\alpha = 0.92$ ; *Goals*,  $\alpha = 0.91$ ; and *Strategies*,  $\alpha = 0.91$ . The DERS overall and subscales have proven convergent validity, exhibiting strong associations with an independent measure of emotion regulation, experiential avoidance. The *Clarity* and *Non-acceptance* subscales also exhibited strong associations with a measure of emotional expressivity.

*Manic and depressive tendencies* were measured with the Seven Up Seven Down scale (7 Up 7 Down; Youngstrom et al., 2013). The 7 Up 7 Down is a 14-item self-report assessment of the lifetime propensity towards manic and depressive symptoms measured on a four-point Likert type scale ranging from 1 = *Never or hardly never* to 4 = *Very often or almost constantly*. Example items include “Have you had periods of extreme happiness and intense energy lasting several days or more when you also felt much more anxious or tense (jittery, nervous, uptight) than usual (other than related to the menstrual cycle)?”, or “Have there been times when you have felt that you would be better off dead?”. Higher scores on the 7 Up and 7 Down scales reflect higher manic and depressive lifetime tendencies

respectively. Items for the 7 Up 7 Down were pooled from the full-length General Behaviour Inventory (DBI; Depue et al., 1981), with the aim to increase the distinctiveness of the mania and depression scales in a briefer format. Both the 7 Up (Youngstrom et al., 2013,  $\alpha = 0.83$ ; current study,  $\alpha = 0.87$ ) and 7 Down (Youngstrom et al., 2013,  $\alpha = 0.95$ ; current study,  $\alpha = 0.93$ ) subscales have demonstrated good internal consistency and exhibited strong associations with the GBI. The 7 Up 7 Down also displayed good criterion-related validity, accurately discriminating between participants with/without a mood disorder (Youngstrom et al., 2013). The 7 Up 7 Down was selected in the current study as a measure of lifetime symptom propensity over more state-based measures of symptom severity, as floor effects using state measures have been reliably documented as a limiting factor in mindfulness-based BD research, particularly in relation to manic mood symptoms (Bojic and Becerra, 2017; Lovas and Schuman-Olivier, 2018).

*Subjective quality of life* was measured with the Quality of Life in Bipolar Disorder Questionnaire (QoL.BD; Michalak et al., 2010). The QoL.BD is a 56-item self-report quality of life assessment specifically designed for people with BD and measured on a five-point Likert scale ranging from 1 = *Strongly disagree* to 5 = *Strongly agree*. The QoL.BD provides a summary for overall subjective quality of life, as well as 12 subdomains, over the last 14 days (e.g., *Over the last 14 days, I have* “had plenty of energy”, “made plans without difficulty”). For the present study, only the overall summary score was examined. Higher scores reflect better subjective appraisals of one’s quality of life. The QoL.BD shows good internal consistency (Michalak et al., 2010,  $\alpha = 0.87$ ; current study,  $\alpha = 0.95$ ), and subscale test-retest reliability ( $\rho$  range: 0.46-0.87). The QoL.BD, both overall and at the subscale level, exhibit strong convergent validity with existing measures of quality of life, well-being, state mood and depression.

### *Statistical Analysis*

Analyses were conducted using IBM SPSS v.27.0. Six participants had missing data on items of the QoL.BD which were replaced using Expectation-Maximization after Little's MCAR test revealed data were missing completely at random.

*To provide a descriptive characterisation of the BD group and to understand the average degree of dispositional mindfulness reported by BD patients – which has not been explicitly assessed in the BD literature to date, both BD and HC groups were compared on demographic variables as well as on the key measures of interest using bootstrapped (1000 samples) independent samples t-tests in preliminary analyses. T-test were considered significant if the 95% bias-corrected bootstrapped confidence interval (CI) did not span zero. Give the focus of this study on understanding interrelations between emotion regulation, dispositional mindfulness, depression and mania tendencies and quality of life in BD, the primary mediation analyses were then conducted in the BD group only. In these analyses, each of the three dependent variables (DVs; 7 Up, 7 Down and QoL.BD) were entered into separate mediation models using the PROCESS (Model 4) procedure for SPSS Version 3.3 (Hayes, 2017). MAAS scores were specified as the independent variable (IV), and the five DERS subscale scores were specified as mediators. Paths between the IV and DV (*c path*), the IV and mediators (*a path*) and the mediators and DV (*b path*) were examined, as were paths reflecting the indirect effect of the IV on the DV through the mediators (*c' path*). To account for multiple testing, coefficients with 95% bias-corrected bootstrapped CI were calculated for all models using 5000 samples, with significant mediation identified if the CI range of the indirect effect did not span zero and there was evidence of a drop in the unstandardized regression (*B*) weight (and *p*-value) of the direct path between the IV and DV. Indirect (bootstrapped) effects were still interpreted in the absence of direct effects between*

the IV and DV, in line with contemporary statistical theories indicating the possibility that mediators can causally exist between the IV and DV even if the association between the IV and DV is not statistically significant (see Hayes, 2017).

As a precaution, all models were re-run including symptom status (i.e. categorical classification as either euthymic or symptomatic) as a covariate to control for any potential mood state effects, and again including age and sex as covariates. However, the pattern of indirect effects did not deviate from that of the analyses reported above. Thus, these results are not presented in the main text for brevity, but they are presented in Supplementary Table S1 and S2 respectively.

## **Results**

### *Descriptive analysis*

The results of the descriptive comparisons of BD and HCs are displayed in Table 1. There were no significant between group differences in age or sex. The BD group had significantly higher 7 Up, 7 Down, DERS subscale, MADRS and YMRS scores, and significantly lower MAAS scores compared to the HC group. Effect sizes for all comparisons were large.

### *Primary meditation analysis*

*Mindfulness-emotion regulation difficulty (i.e., a path)*: Lower MAAS scores significantly predicted higher scores on all five DERS subscales (Clarity [ $B = -0.17, t = 5.52, p < .001$ ]; Goals [ $B = -0.22, t = 4.40, p < .001$ ]; Impulse [ $B = -0.22, t = 6.18, p < .001$ ]; Non-acceptance [ $B = -0.25, t = 4.11, p < .001$ ]; Strategies [ $B = -0.28, t = 5.55, p < .001$ ]). As this was the same for each model, for brevity this is not repeated in the reporting of each model's results below.

*Depressive Tendencies:* Lower MAAS scores were found to significantly predict higher 7 Down scores ( $B = -0.17, t = 3.47, p \leq .001$ ). When all variables were included in the model, the direct effect between MAAS and 7 Down scores became non-significant ( $B = -0.06, p = .26$ ), and a significant total indirect effect of MAAS on the 7 Down was detected ( $B = -0.11, 95\% \text{ CI} = [-0.21, -0.03]$ ). From the five DERS subscales, only the *Strategies* subscale score was detected as a significant mediator ( $B = -0.14, 95\% \text{ CI} = [-0.25, -0.04]$ ). Thus, *Strategies* subscale scores fully mediated the relationship between scores on the MAAS and the 7 Down, with the model explaining 39% of the variance in the latter.

- Insert Figure 1 around here -

*Manic Tendencies:* Lower MAAS scores were found to significantly predict higher 7 Up scores ( $B = -0.08, t = 2.19, p \leq .05$ ). When all variables were included in the model, the direct effect between MAAS and 7 Up scores became non-significant ( $B = -0.06, p = .21$ ), however no significant total or subscale-specific indirect effects were detected.

*Subjective Quality of Life:* Lower MAAS scores predicted lower QoL.BD scores ( $B = 1.06, t = 4.01, p \leq .001$ ). When all variables were included in the model, the direct effect between MAAS and QoL.BD scores became non-significant ( $B = 0.33, p = .27$ ), and a significant total indirect effect of MAAS scores on QoL.BD scores was detected ( $B = 0.72, 95\% \text{ CI} = [0.32, 1.18]$ ). From the five DERS subscales, only the *Clarity* subscale score was detected as a significant mediator ( $B = 0.39, 95\% \text{ CI} = [0.04, 0.82]$ ). Thus, *Clarity* subscale scores fully mediated the relationship between scores on the MAAS and QoL.BD with the model explaining 40% of the variance in the latter.

- Insert Table 2 around here –

## Discussion

In this study, we sought to contribute to the understanding of dispositional mindfulness and its influence on BD. To this end, we examined i) BD-HC differences in dispositional mindfulness, ii) determined relationships between mindfulness, and depressive and manic tendencies as well as and subjective quality of life in BD, and iii) identified whether these relationships were mediated by difficulties in emotion regulation.

As expected, lower dispositional mindfulness was reported by BD patients than HCs. To our knowledge, this is the first instance in which this has been explicitly documented in the BD literature. Lower mindfulness in BD patients was also associated with more severe depressive tendencies, as well as worse quality of life. These associations were found to be mediated by difficulties in facets of emotion regulation. Specifically, difficulties in strategy use mediated the relationship between mindfulness and depressive tendencies, whilst emotional clarity mediated the relationship with subjective life quality. No associations were detected for tendencies towards mania.

It is noteworthy that the impact of mindfulness on depressive tendencies in BD occurred via its effect on the *Strategies* subscale of the DERS. Variation on this subscale reflects the extent to which one believes that emotions can be effectively regulated under periods of distress, with BD patients tending to believe they cannot regulate emotions compared to controls (Van Rheenen et al., 2020; Van Rheenen et al., 2015). There is evidence that the belief that one is unable to execute a behaviour reduces the degree to which effort is exerted to employ that behaviour (Bandura, 1977), such that the belief impinges on the capacity to successfully handle distressing situations or emotions. Mindfulness may

remedy this by facilitating a sense of competency and self-control via its promotion of emotional acceptance (Luberto et al., 2014). In BD, the belief that emotions cannot be effectively regulated may thus be exacerbated because dispositional mindfulness is lower than normal, and this may contribute to greater tendencies towards depression.

In our BD data, difficulties in emotion regulation, particularly in terms of the ability to identify, monitor and understand one's emotions (i.e., emotional clarity), mediated the relationship between mindfulness and subjective quality of life. Greater clarity in one's emotions has been consistently related to better subjective well-being and life satisfaction, possibly because it contributes to a sense of purpose and capacity for interpersonal relationship building (Lischetzke and Eid, 2017). Our findings suggest that in BD, lower levels of mindfulness negatively influence this process because the capacity to non-judgementally observe over present moment experiences in such a manner that emotions can be clearly identified, differentiated and understood, is reduced (Cooper et al., 2018). This then leads to a worse quality of life.

Lower dispositional mindfulness was related to more severe manic tendencies when emotion regulation was not included in the regression model. However, emotion regulation difficulties did not play a role here, as they were found to be unrelated to manic tendencies. Whilst this is consistent with past work examining this relationship (Van Rheenen et al., 2015), it should be noted that the measure of emotion regulation used here is framed primarily with regard to the regulation of negative emotions, while the regulation of positive emotions may be more relevant to manic symptoms. Thus, it is possible that this absence of relationship was related more to the use of the DERS in this study, than the absence of a relationship between emotion regulation difficulties and manic tendencies entirely. Future studies would do well to assess this relationship again in the context of an emotion regulation

scale such as The Perth Emotion Regulation Competency Inventory, which also measures the ability to regulate positive emotions (Preece et al., 2018).

The study had a number of limitations. Firstly, the cross-sectional design precludes causal inference. Secondly, the current study utilised the MAAS, which conceptualises mindfulness as unidimensional not multidimensional (see Baer et al., 2004; Baer et al., 2006); it is possible that different dimensions of mindfulness have differential effects on the key variables examined here. Thirdly, we assessed depressive and manic tendencies using a self-report measure that taps into trait qualities and is inherently prone to bias due to its subjective nature. Thus, it would be relevant for future studies to assess whether the association between dispositional mindfulness, emotion regulation difficulties and manic or depressive dimensions differ when assessed using observer rated and state-based symptom measures. Finally, as the current study represented a secondary analysis of data previously collected, the sample size was limited by the number of participants who had complete datasets available. Thus, the current study may have been insufficiently powered to detect smaller indirect effects (i.e., the mania proneness analysis). Although appropriate statistical techniques were employed (i.e., bias corrected bootstrap confidence intervals; Hayes and Scharkow, 2013) and the findings were in line with existing research, larger samples and further work aimed at replication are needed to definitively comment on the influence emotion regulation has on the relationship between dispositional mindfulness and mania proneness.

In conclusion, BD patients with low levels of dispositional mindfulness may experience worse depressive tendencies and perceived life quality. These associations could be explained by specific difficulties with emotion regulation. It appears that higher mindfulness supports a greater sense or belief amongst patients with BD that they have access to emotion regulation strategies and clarity around the nature of their emotions. Given that BD patients experience a variety of emotion regulation, mood, and psychosocial



problems, our findings provide further support for the use of formal mindfulness training as an alternative or adjunct therapy for BD. By therapeutically raising resting mindfulness levels in BD patients via formal training, it is likely that a range of clinical, affective, and psychosocial benefits will arise.

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Table 1. Sample characteristics						
	<i>n</i>	Bipolar Group	<i>n</i>	Healthy Control Group	BCa 95% CI	Cohen's <i>d</i>
Age	66	37.73 (11.61)	28	35.11 (11.72)	-3.17, 8.11	0.23
Female / Male	32 / 34		16/12		$\chi(1) = .590, p = .44$	0.79 <sup>#</sup>
BD Type I / Type II	62 / 4					
Age of diagnosis	66	29.0 (10.2)				
Age of Sx onset	66	22.7 (9.6)				
Mood stabilizer <i>n</i>	22 (33%)					
Antipsychotic <i>n</i>	25 (38%)					
MADRS	66	8.26 (7.43)	28	1.39 (1.95)	5.05, 9.71	1.09
YMRS	61	3.60 (3.37)	23	0.61 (1.16)	2.07, 3.95	1.00
MAAS	66	56.62 (11.83)	28	69.57 (10.82)	-18.19, -7.73	1.22
DERS						
Clarity	66	11.29 (4.00)	28	8.96 (3.10)	0.72, 3.90	0.62
Goals	66	15.40 (5.56)	28	10.93 (3.05)	3.24, 7.00	1.01
Impulse	66	12.96 (5.07)	28	8.18 (2.18)	3.43, 6.24	1.08
Non-Acceptance	66	14.52 (6.34)	28	9.89 (3.92)	2.32, 6.66	0.81
Strategies	66	18.21 (6.68)	28	9.93 (2.69)	6.42, 10.12	1.43
7 Down	66	17.03 (5.06)	28	8.47 (1.90)	7.14, 9.91	1.96
7 Up	66	14.68 (3.75)	28	9.14 (2.74)	3.98, 7.10	1.59
QoL.BD	66 <sup>a</sup>	164.89 (27.82)	28 <sup>b</sup>			

Note: # Cramer's V; <sup>a</sup>missing data imputed for five participants; <sup>b</sup>missing data imputed for one participant; 7 Up, Seven Up, 7 Down, Seven Down, BD, bipolar disorder; BCa, bias corrected accelerated; CI, confidence interval; DERS, Difficulties in Emotion Regulation Scale; MAAS, Mindfulness Attention Awareness Scale; MADRS, Montgomery-Åsberg Depression Rating Scale; QoL.BD, Quality of Life in Bipolar Disorder Questionnaire; Sx, symptom YMRS, Young Mania Rating Scale

Table 2. Indirect effects of mindfulness on depressive and manic tendencies and subjective quality of life through different mediating variables.										
	7 Down			7 Up			QoL.BD			
	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$	
Total	-0.11	<b>-0.20, -0.03</b>	-0.25	-0.02	-0.11, 0.05	-0.08	0.72	<b>0.31, 1.17</b>	0.31	
DERS Clarity	0.00	-0.05, 0.06	0.00	0.01	-0.04, 0.06	0.02	0.39	0.04, 0.83	0.17	
DERS Goals	0.04	-0.04, 0.08	0.08	-0.03	-0.09, 0.01	-0.11	0.01	-0.34, 0.40	0.01	
DERS Impulse	-0.02	-0.11, 0.05	-0.05	-0.05	-0.15, 0.02	-0.16	0.13	-0.18, 0.52	0.06	
DERS Non-Acceptance	0.02	-0.05, 0.07	0.04	0.05	-0.01, 0.12	0.16	-0.03	-0.38, 0.27	-0.01	
DERS Strategies	-0.14	<b>-0.24, -0.04</b>	-0.32	0.00	-0.07, 0.07	0.01	0.22	-0.24, 0.68	0.92	

Note: The values reported in the total row refer to the total indirect effects; Bold denotes significant mediation due to CI range not spanning zero; 7 Down, Seven Down; CI, confidence interval, DERS, Difficulties in Emotion Regulation Scale; QoL.BD Quality of Life in Bipolar Disorder

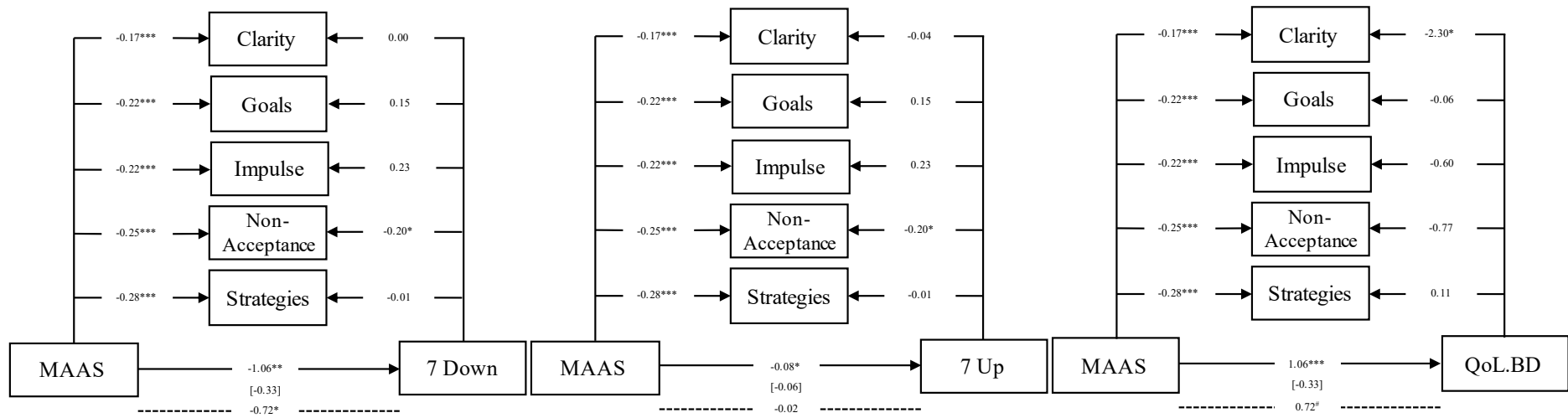


Figure 1. Graphical depiction of results of mediation analyses. Note that the direct effects are represented by solid lines, total effects are represented in parenthesis and indirect effects are represented by dotted lines. Values represent unstandardized beta values. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$ ; #95% bias-corrected bootstrapped CI range did not span zero; 7 Down = Seven Down; 7 Up = Seven Up; DERS = Difficulties in Emotion Regulation Scale; MAAS = Mindfulness Attention Awareness Scale; QoL.BD = Quality of Life in Bipolar Disorder Questionnaire

### Supplementary Material

**Title:** Mindfulness, mood symptom tendencies and quality of life in bipolar disorder: An examination of the mediating influence of emotion regulation difficulties.

**Authors:** Sean P. Carruthers, Susan L. Rossell, Greg Murray, James Karantonis, Lisa S. Furlong, Tamsyn E. Van Rheenen

Table S1. Indirect effects of mindfulness on depressive and manic tendencies and subjective quality of life through different mediating variables whilst covarying for symptom status									
	7 Down ( <i>n</i> = 65)			7 Up ( <i>n</i> = 65)			QoL.BD ( <i>n</i> = 65)		
	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$
Total	-0.11	<b>-0.20, -0.03</b>	-0.25	-0.03	-0.10, 0.05	-0.08	0.73	<b>0.33, 1.19</b>	0.31
DERS Clarity	-0.01	-0.06, 0.05	-0.02	0.00	-0.05, 0.06	0.00	0.45	<b>0.11, 0.87</b>	0.17
DERS Goals	0.02	-0.07, 0.08	0.05	-0.04	-0.10, 0.00	-0.13	0.12	-0.29, 0.54	0.01
DERS Impulse	-0.02	-0.11, 0.06	-0.05	-0.05	-0.13, -0.02	-0.14	0.13	-0.24, 0.51	0.06
DERS Non-Acceptance	0.02	-0.06, 0.08	0.04	0.05	-0.01, 0.11	0.15	-0.02	-0.35, 0.29	-0.01
DERS Strategies	-0.11	<b>-0.22, -0.03</b>	-0.27	0.01	-0.05, 0.08	0.04	0.05	-0.34, 0.53	-0.09

Note: Cs $\beta$ , completely standardised indirect effect; Bold denotes significant mediation concluded due to CI range not spanning zero; 7 Down, Seven Down; CI, confidence interval, DERS, Difficulties in Emotion Regulation Scale; QoL.BD Quality of Life in Bipolar Disorder

Table S2. Indirect effects of mindfulness on depressive and manic tendencies and subjective quality of life through different mediating variables whilst covarying for age and sex									
	7 Down ( <i>n</i> = 66)			7 Up ( <i>n</i> = 66)			QoL.BD ( <i>n</i> = 66)		
	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$	$\beta$	95% CI	Cs $\beta$
Total	-0.10	<b>-0.20, -0.12</b>	-0.24	-0.02	-0.10, 0.06	-0.05	0.81	<b>0.43, 1.23</b>	0.35
DERS Clarity	-0.01	-0.06, 0.05	-0.01	0.01	-0.04, 0.54	0.02	0.35	<b>0.02, 0.77</b>	0.15
DERS Goals	0.02	-0.05, 0.07	0.05	-0.05	-0.11, 0.01	-0.16	-0.10	-0.44, 0.27	-0.04
DERS Impulse	-0.02	-0.11, 0.05	-0.05	-0.06	-0.14, 0.01	-0.17	0.12	-0.20, 0.48	0.05
DERS Non-Acceptance	0.02	-0.05, 0.08	0.06	0.054	-0.01, 0.11	0.17	0.02	-0.33, 0.30	0.01
DERS Strategies	-0.12	<b>-0.23, -0.03</b>	-0.29	0.33	-0.04, 0.11	0.10	0.32	-0.05, 0.95	0.18

Note: Cs $\beta$ , completely standardised indirect effect; Bold denotes significant mediation concluded due to CI range not spanning zero; 7 Down, Seven Down; CI, confidence interval, DERS, Difficulties in Emotion Regulation Scale; QoL.BD Quality of Life in Bipolar Disorder