How do dispositional mindfulness and self-compassion alleviate loneliness? The mediating role of rejection sensitivity

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Abstract

Loneliness is detrimental to both mental and physical health. Previous studies have suggested that mindfulness and self-compassion could alleviate loneliness, but the mechanisms are largely unknown. The current cross-sectional study investigated whether rejection sensitivity played a mediating role in the associations between dispositional mindfulness and self-compassion with loneliness. Two hundred and seventy-five Canadian adults were recruited from social media platforms and filled out questionnaires measuring dispositional mindfulness, self-compassion, rejection sensitivity, and loneliness. Results of data analyses showed that both dispositional mindfulness and self-compassion were significantly and negatively associated with rejection sensitivity and loneliness. Rejection sensitivity had a significant and positive relationship with loneliness. Most importantly, rejection sensitivity significantly mediated the associations between dispositional mindfulness and self-compassion with loneliness. The results suggest that rejection sensitivity can explain the relationship mindfulness and self-compassion have with loneliness. This study provides a new perspective for understanding how and why mindfulness and self-compassion could alleviate loneliness. It also suggests that the impact mindfulness and self-compassion training have on loneliness could be maximized by focusing on rejection sensitivity.

Keywords Mindfulness · Self-compassion · Loneliness · Rejection sensitivity · Mechanism · Mediation

Introduction

Loneliness is a perceived discrepancy between one's expected and actual social relationship status (Peplau & Perlman, 1982), and it is detrimental to individuals' health. For example, loneliness has been found to be associated with increased depressive symptoms (Cacioppo et al., 2010). Loneliness is also a risk factor for suicidal ideation and behaviors (McClelland et al., 2020) as well as non-suicidal self-injury (Madjar et al., 2021). The detrimental effects of loneliness are not restricted to mental health outcomes.

Loneliness has been found to increase the incidence of cancer (Kraav et al., 2021), as well as the risk of having heart disease, and a stroke (Valtorta et al., 2016). Moreover, longitudinal studies showed that loneliness was associated with a 20 to 30 percent increase in the risk of mortality, and that impaired health conditions accounted for the relationship between loneliness and risk of mortality (Henriksen et al., 2019; Luo et al., 2012; Wang et al., 2020). In sum, loneliness is closely associated with various mental and physical health problems, which supports the urgency of studying interventions and protective factors for loneliness.

Mindfulness is a promising tool that could alleviate loneliness. Mindfulness is commonly conceptualized as having an intentional awareness of experiences happening in the present moment, and an attitude of openness and nonjudgment (Kabat-Zinn, 2009). People differ in their ability to stay mindful across daily situations. Individuals' general tendency to be mindful of internal and external stimuli can be defined as dispositional mindfulness (Brown et al., 2007), which can be augmented through mindfulness-based interventions (MBIs) such as Mindfulness-Based Stress Reduction (Kabat-Zinn, 1982) and Mindfulness-Based Cognitive

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Therapy (Segal et al., 2002). Over the past several decades, much evidence has been gained for the benefits of mindfulness on a wide variety of outcomes (e.g., mental health, physical health, relational outcomes) across different populations (Carpenter et al., 2019; Creswell et al., 2019; Goldberg et al., 2021; Khoury et al., 2013; Quinn-Nilas, 2020). Cross-sectional and longitudinal studies showed that dispositional mindfulness could negatively predict loneliness and positively predict social connectedness (Clear et al., 2020; Rehman et al., 2021). Randomized controlled studies also demonstrated the effectiveness of MBIs in reducing feelings of loneliness in different populations, such as older adults (Creswell et al., 2012) and college students (Zhang et al., 2018). Therefore, cross-sectional, longitudinal, and intervention (i.e., experimental) studies all supported the efficacy of mindfulness in reducing loneliness.

Another construct that is closely related to mindfulness is self-compassion, which is defined as one's tendency to bring a compassionate attitude toward oneself when encountering difficulties or setbacks (Neff, 2003a, b). Self-compassion involves treating oneself in a kind, warm, and supportive way, being mindful of negative emotions, and viewing difficulties as experiences that are shared by all humans (Neff, 2003a, b). Similar to dispositional mindfulness, self-compassion can be cultivated through training programs, such as the Mindful Self-Compassion Program (Neff & Germer, 2013) and Compassion-Focused Therapy (Gilbert, 2009). Over the past two decades, research showed that people who are more self-compassionate or received self-compassion training have fewer psychological symptoms, better cognitive and psychological well-being, more health behaviors, and better physical health (Ferrari et al., 2019; MacBeth & Gumley, 2012; Phillips & Hine, 2021; Zessin et al., 2015). Previous studies have suggested that both dispositional self-compassion and self-compassion training are associated with lower levels of loneliness and increased feelings of connectedness with others (Brooker et al., 2019; Farzanfar et al., 2020; Ghezelseflo & Mirza, 2020). Although the relationship mindfulness and self-compassion have with loneliness has been well established in previous studies, the underlying mechanisms of these associations are largely unknown.

An important predisposing factor for loneliness is rejection sensitivity (Spithoven et al., 2017). Rejection sensitivity is defined as a heightened sensitivity to rejection that is manifested through an anxious expectation of being rejected, an oversensitivity to social rejection cues, and an overreaction to perceived social rejection (e.g., anger and aggression, hurt and social withdrawal; Downey & Feldman, 1996). Theoretically, the overreaction to perceived social rejection can exacerbate feelings of loneliness and result in a self-fulfilling prophecy (i.e., real social rejection from others; Levy et al., 2001). A recent meta-analysis (Gao et al., 2017) found a significant moderate association between rejection sensitivity and loneliness (pooled $r = 0.386$). Moreover, this meta-analysis showed that among longitudinal studies, baseline rejection sensitivity significantly predicted loneliness at follow-up, with a medium effect size ($r = 0.320$).

Through a non-judgmental and non-reactive awareness of present-moment experiences, mindfulness could increase awareness and acceptance of negative emotions, reduce impulsivity, and increase goal-directed behaviors when faced with negative emotions (Freudenthaler et al., 2017). This could help in decreasing anxiety related to the fear of social rejection, and the maladaptive overreaction to perceived rejection. Indeed, dispositional mindfulness could reduce rejection fears and maladaptive behaviors (e.g., hurting others) when interpersonal conflicts arise (Dixon & Overall, 2018). In addition, brief mindfulness practice facilitated rapid recovery of negative emotions and rejection feelings triggered by perceived social rejection (Keng & Tan, 2018). Heppner et al. (2008) showed that a five-minute mindfulness practice reduced aggressive behaviors triggered by social rejection compared with the rejection-only condition. Interestingly, participants who practiced mindfulness and received social rejection did not react more aggressively than those who were socially accepted. Moreover, both dispositional mindfulness and mindfulness training have been linked with lower levels of rejection sensitivity (Hafner et al., 2019; Joss et al., 2020; Peters et al., 2015; Velotti et al., 2015).

Similarly, when people expect or perceive social rejection signals, self-compassion may help to reduce their anxious feelings and maladaptive responses by increasing kindness towards themselves, decreasing negative emotions, and reconsidering their rejection experiences (or expectations) as being shared by other people. Indeed, research showed that people higher on self-compassion tended to have fewer negative emotions when experiencing, recalling, and imagining negative events (including interpersonal rejection), and think more adaptively (e.g., less rumination, more embrace of responsibility) which helped them deal with the events (Leary et al, 2007). Experimentally induced self-compassion was also found to increase positive affect compared with simply exploring the emotions (control condition) after recalling intense interpersonal rejection (Koch, 2020). Correlational evidence also directly supported that people with higher dispositional self-compassion had lower levels of rejection sensitivity (Gerber et al., 2015; Sakiz & Sariçam, 2015; Sommerfeld & Shechory-Bitton, 2020).

Given that rejection sensitivity is a predisposing factor for loneliness, and that mindfulness and self-compassion could reduce rejection sensitivity, it is plausible that mindfulness and self-compassion may alleviate loneliness through the reduction of rejection sensitivity. However, no studies have investigated these hypotheses. Testing these hypotheses could help clarify the mechanisms linking mindfulness and

self-compassion with loneliness. Moreover, it may help in improving existing self-compassion and mindfulness-based interventions to optimize their effects on loneliness. The current study aimed to examine whether rejection sensitivity mediates the associations between mindfulness and self-compassion with loneliness. We hypothesized that 1) mindfulness and self-compassion would be significantly and negatively associated with loneliness, 2) mindfulness and self-compassion would be significantly and negatively associated with rejection sensitivity, 3) rejection sensitivity would have a significant and positive relationship with loneliness, and most importantly, 4) rejection sensitivity would significantly mediate the associations between mindfulness and self-compassion with loneliness.

Method

Procedure and participants

This study was approved by the Institutional Review Board of McGill University. Participants were Canadian adults ($n = 275$) recruited across Canada between January and March 2021. Advertisements of the study were posted on various groups hosted on social media platforms (e.g., Facebook, Reddit). Inclusion criteria consisted of speaking English and being over the age of 18 years. Participants were compensated with a chance to win a gift card priced at 75 Canadian dollars (the chance of winning was 1 in 30). Participants completed a 30-min online survey on the platform LimeSurvey (Version 2.0; Limesurvey GmbH, 2005). The online survey collected self-report data on sociodemographic characteristics, dispositional mindfulness, self-compassion, rejection sensitivity, and loneliness. Informed consent was obtained from participants before they started to complete the survey. The mean age of the sample was 24.32 ($SD = 7.47$), 71.3% identified as female, and 54.54% as Caucasian. See Table 1 for all sociodemographic characteristics.

Measures

The Five-Facet Mindfulness Questionnaire (FFMQ) was administered to measure dispositional mindfulness (Baer et al., 2006). The FFMQ is a 39-item measure divided into five subscales that assess different facets of mindfulness, namely observing, describing, acting with awareness, nonjudging, and nonreactivity (Baer et al., 2006). Participants rate items on a Likert scale ranging from 1 (*Never or Very Rarely True*) to 5 (*Very Often or Always True*; Baer et al., 2006). Sample items include "I can watch my feelings without getting attached to them" and "I judge

Table 1 Sociodemographic characteristics

Demographics	Percent (%)
Gender	
Man	25.5
Woman	71.3
Gender-variant/Non-conforming	2.5
Trans	0.4
Highest Education Completed	
Not completed high school	0
High school graduate	25.3
Some college/AA degree/Technical school training	33.3
College graduate (BA or BS)	28.2
Graduate school degree: Master's or Doctorate degree	11.7
Other	1.5
Ethnicity	
White	54.54
South Asian	14.2
Chinese	15.3
Black	2.2
Filipino	2.5
Latin American	4.0
Arab	3.3
Southeast Asian	4.0
West Asian	1.8
Korean	2.5
Japanese	3.6
Indigenous Descent	1.5
Relationship Status	
Single	47.6
In an exclusive relationship	37.8
In a non-exclusive relationship	1.5
Married	10.2
Engaged	0.4
Divorced	1.1
Widowed	0
Other	1.5
Status	
Citizen	82.4
Permanent Resident	5.9
Refugee	0.4
International Student	11
Other	0.4
Income	
Less than $5,000	2.3
$5,000—$19,999	12.3
$20,000—$49,999	28.8
$50,000—$99,999	27.4
$100,000—$149,999	13.2
More than $150,000	16
Country of Residence	
Canada	93.8
Other	6.2

my thoughts as good or bad" (Baer et al., 2006). The scale has demonstrated adequate psychometric properties (Baer et al., 2006). In the present study, alpha coefficients were 0.75 for observing, 0.85 for describing, 0.86 for acting

with awareness, 0.90 for nonjudging, 0.77 for nonreactivity, and 0.89 for the total score.

The 26-item Self-Compassion Scale (SCS) was used to measure self-compassion (Neff, 2003a, b). The SCS includes subscales measuring self-kindness, self-judgment, common humanity, isolation, mindfulness, and over-identification (Neff, 2003a, b). Responses are given on a Likert scale ranging from 1 (*Almost Never*) to 5 (*Almost Always*; Neff, 2003a, b). Sample items include "When I'm down, I remind myself that there are lots of other people in the world feeling like I am" and "I'm kind to myself when I'm experiencing suffering" (Neff, 2003a, b). The scale has demonstrated good psychometric properties, including good internal reliability for the total and subscale scores (Neff, 2003a, b). In this study, alpha coefficients were 0.85 for self-kindness, 0.85 for self-judgment, 0.79 for common humanity, 0.77 for isolation, 0.73 for mindfulness, 0.76 for over-identification, and 0.93 for the total score.

The 18-item Rejection Sensitivity Questionnaire-Adult Version (RSQ-A; Berenson et al., 2009), adapted from the Rejection Sensitivity Questionnaire developed by Downey and Feldman (1996), was used to measure rejection sensitivity for adults. The scale contains nine hypothetical scenarios where interpersonal rejection may occur, and each scenario corresponds to two items (Berenson et al., 2009). A "rejection concern" item asks participants to report their concerns about rejection or acceptance shown by the person they are interacting with in the scenario, rated from 1 (*Very Unconcerned*) to 6 (*Very Concerned*; Berenson et al., 2009). A "rejection expectancy" item asks participants to report the likelihood of expected interpersonal acceptance to occur in such a scenario, rated from 1 (*Very Unlikely*) to 6 (*Very Likely*; Berenson et al., 2009). For example, one scenario in the scale is "You ask your parents or other family members to come to an occasion important to you." (Berenson et al., 2009). The "rejection concern" item of this scenario is "How concerned or anxious would you be over whether or not they would want to come?", and the "rejection expectancy" item is "I would expect that they would want to come." (Berenson et al., 2009). The rejection expectancy item for each scenario is reverse scored and then multiplied by the score of the corresponding rejection concern item (Berenson et al., 2009). The scores of the nine scenarios are averaged to obtain the score of rejection sensitivity (Berenson et al., 2009). Higher average scores indicate higher rejection sensitivity. The RSQ-A has shown good validity (Berenson et al., 2009). In this study, the alpha coefficient was 0.70.

The 20-item UCLA Loneliness Scale (Version 3; UCLA-3; Russell, 1996) was used to measure levels of loneliness. Each item asks about the frequency participants feel lonely or socially connected (Russell, 1996). For example, one item asks, "How often do you feel that you lack companionship?" (Russell, 1996). Participants rate the frequency

from 1 (*Never*) to 4 (*Often*; Russell, 1996). The total score of 20 items (ranging from 20 to 80) reflects levels of loneliness, with a greater total score representing higher loneliness (Russell, 1996). The scale has high reliability and validity (Russell, 1996). In this study, the alpha coefficient was 0.90.

Data analyses

First, a correlation analysis was conducted to examine the associations among dispositional mindfulness, self-compassion, rejection sensitivity, and loneliness. Then, independent mediation analyses were conducted to test whether rejection sensitivity significantly mediated the relationship between mindfulness and self-compassion with loneliness. To test the mediating effects, Model 4 of the PROCESS procedure for SPSS (Hayes, 2013) was used. The bootstrapping procedure with 95% confidence intervals (CIs) and 5000 resamples was conducted. CIs that do not include zero indicated significant indirect effects.

Results

Missing values

Missing values across the study variables and participants were minimal and did not exceed 5%. All missing values were replaced using the multiple imputation method (Rubin, 2004). The multiple imputation was performed using the programming language *R* (R Core Team, 2020) and the package *mice* (Version 3.13.0; Van Buuren & Groothuis-Oudshoorn, 2011).

Correlation analyses

Pearson correlations among mindfulness, self-compassion, rejection sensitivity, and loneliness can be found in Table 2. Correlation analyses showed that dispositional mindfulness and its four facets (except for the observing facet) were negatively related to loneliness and rejection sensitivity. Self-compassion and its six dimensions were significantly and negatively related to loneliness and rejection sensitivity. As well, there was a significant and positive association between rejection sensitivity and loneliness.

Mediation analyses

Given that the observing facet was not significantly related to loneliness and rejection sensitivity, we did not conduct mediation analyses using this facet. The unstandardized indirect effects of dispositional mindfulness, self-compassion and their facets on loneliness through rejection sensitivity were all significant (Total Dispositional Mindfulness:

Table 2 Descriptive statistics and correlations between study variables

| Measures	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Mindfulness Total	-														
2. Observing	.39***	-													
3. Describing	.73***	.20***	-												
4. Acting with Awareness	.65***	-.03	.34***	-											
5. Nonjudging	.71***	-.09	.34***	.44***	-										
6. Nonreactivity	.63***	.31***	.36***	.17**	.32***	-									
7. Self-Compassion Total	.65***	.14*	.41***	.38***	.55***	.56***	-								
8. Self-Kindness	.52***	.20***	.37***	.23***	.42***	.42***	.80***	-							
9. Common Humanity	.34***	.25***	.25***	.11	.13*	.39***	.64***	.53***	-						
10. Mindfulness	.56***	.29***	.37***	.22***	.33***	.61***	.77***	.68***	.64***	-					
11. Self-Judgment	-.60***	-.01	-.34***	-.40***	-.64***	-.40***	-.82***	-.65***	-.44***	-.44***	-				
12. Isolation	-.45***	.07	-.28***	-.39***	-.45***	-.32***	-.76***	-.40***	-.35***	-.35***	.68***	-			
13. Over-Identification	-.53***	.01	-.27***	-.39***	-.52***	-.45***	-.78***	-.44***	-.47***	-.47***	.70***	.67***	-		
14. Rejection Sensitivity	-.46***	-.08	-.45***	-.29***	-.32***	-.28***	-.38***	-.33***	-.31***	-.31***	.31***	.29***	.24***	-	
15. Loneliness	-.46***	.00	-.44***	-.30***	-.37***	-.28***	-.46***	-.39***	-.32***	-.32***	.40***	.41***	.33***	.57***	-
Mean	118.25	26.35	26.35	22.45	23.29	20.41	2.75	2.87	2.95	3.04	3.47	3.42	3.46	10.89	2.46
SD	17.91	5.23	5.95	5.86	7.12	4.32	0.66	0.84	0.90	0.76	0.90	0.94	0.89	4.47	0.57

*$p < .05$; **$p < .01$; ***$p < .001$

Table 3 Mediation analysis results demonstrating the mediating role of rejection sensitivity in the associations between dispositional mindfulness and self-compassion with loneliness

Independent Variable (IV)	Mediator (M)	Dependent variable (DV)	Effect of IV on M (a)	Effect of M on DV (b)	Direct effect (c')	Indirect effect	
						(a × b)	95% CI
Mindfulness Total	Rejection Sensitivity	Loneliness	-0.463***	0.460***	-0.249***	-0.213	[-0.283, -0.146]
Describing			-0.451***	0.472***	-0.228***	-0.213	[-0.288, -0.141]
Acting with Awareness			-0.293***	0.533***	-0.142**	-0.156	[-0.222, -0.092]
Nonjudging			-0.317***	0.508***	-0.212***	-0.161	[-0.223, -0.099]
Nonreactivity			-0.279***	0.538***	-0.131*	-0.150	[-0.218, -0.085]
Self-compassion Total			-0.383***	0.466***	-0.284***	-0.179	[-0.248, -0.112]
Self-kindness			-0.332***	0.500***	-0.225***	-0.166	[-0.240, -0.097]
Self-judgment			0.312***	0.500***	0.240***	0.156	[0.092, 0.224]
Common Humanity			-0.275***	0.543***	-0.117*	-0.149	[-0.219, -0.084]
Isolation			0.285***	0.500***	0.263***	0.143	[0.084, 0.205]
Mindfulness			-0.306***	0.526***	-0.162**	-0.161	[-0.230, -0.094]
Over-identification			0.245***	0.527***	0.196***	0.129	[0.062, 0.196]

The pathways linking the independent variables, mediator, and dependent variables (i.e., a, b, and c') on the mediation models were all standardized beta (β) coefficients. The indirect effect of each mediation model was completely standardized. $^*p < .05;$ $^{**}p < .01;$ $^{***}p < .001$
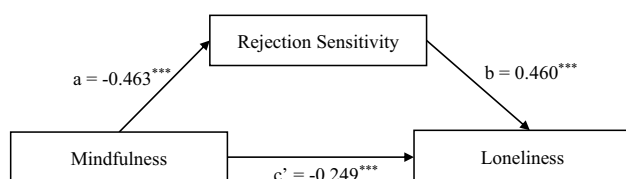
Fig. 1 Mediating effect of rejection sensitivity in the relationship between overall dispositional mindfulness and loneliness. Note. Mindfulness = the overall score of the Five-Facet Mindfulness Questionnaire (Baer et al., 2006). Rejection sensitivity = the overall score of the Rejection Sensitivity Questionnaire-Adult Version (Berenson et al., 2009). Loneliness = the overall score of the UCLA Loneliness Scale (Version 3; Russell, 1996). All path coefficients were standardized coefficients. $^{***}p < .001$
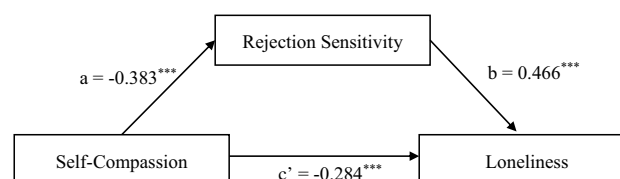
Fig. 2 Mediating effect of rejection sensitivity in the relationship between overall self-compassion and loneliness. Note. Self-Compassion = the overall score of the Self-Compassion Scale (Neff, 2003a, b). Rejection sensitivity = the overall score of the Rejection Sensitivity Questionnaire-Adult Version (Berenson et al., 2009). Loneliness = the overall score of the UCLA Loneliness Scale (Version 3; Russell, 1996). All path coefficients were standardized coefficients. $^{***}p < .001$

$\beta = -0.007$, 95% CI [-0.009, -0.005]; Describing: $\beta = -0.020$, 95% CI [-0.028, -0.013]; Acting with Awareness: $\beta = -0.015$, 95% CI [-0.022, -0.009]; Nonjudging: $\beta = -0.013$, 95% CI [-0.018, -0.008]; Nonreactivity $\beta = -0.020$, 95% CI [-0.029, -0.011]; Total Self-compassion: $\beta = -0.153$, 95% CI [-0.217, -0.098]; Self-kindness: $\beta = -0.112$, 95% CI [-0.163, -0.066]; Self-judgment: $\beta = 0.098$, 95% CI [0.057, 0.143]; Common Humanity: $\beta = -0.094$, 95% CI [-0.141, -0.052]; Isolation: $\beta = 0.086$, 95% CI [0.049, 0.127]; Mindfulness: $\beta = -0.120$, 95% CI [-0.174, -0.072]; Over-identification: $\beta = 0.083$; 95% CI [0.040, 0.128]). Table 3 shows standardized path coefficients and completely standardized indirect effects for the mediation models. Figures 1 and 2 show the mediating effect of rejection sensitivity in the relationship between the overall dispositional mindfulness and self-compassion with loneliness.

Discussion

The current study investigated whether rejection sensitivity mediated the associations dispositional mindfulness and self-compassion had with loneliness in a general adult population. We hypothesized that 1) mindfulness and self-compassion would be significantly and negatively associated with loneliness, 2) mindfulness and self-compassion would be significantly and negatively associated with rejection sensitivity, 3) rejection sensitivity would have a significant and positive relationship with loneliness, and most importantly, 4) rejection sensitivity would significantly mediate the associations between mindfulness and self-compassion with loneliness.

We found that dispositional mindfulness and its four facets (except the observing facet), self-compassion and

all its facets, rejection sensitivity, and loneliness were significantly correlated with each other in the predicted direction, supporting the first three hypotheses. These results are congruent with findings of previous studies showing that mindfulness and self-compassion are associated with reduced loneliness (e.g., Clear et al., 2020; Creswell et al., 2012; Ghezelseflo & Mirza, 2020; Neff & Germer, 2013; Smith et al., 2019) and rejection sensitivity (Gerber et al., 2015; Hafner et al., 2019; Joss et al., 2020; Peters et al., 2015; Sakiz & Sariçam, 2015; Velotti et al., 2015), and that rejection sensitivity is a risk factor for loneliness (Spithoven et al., 2017). The absence of significant associations between the observing facet with rejection sensitivity and loneliness was not surprising. In fact, some meta-analytic evidence has shown that the observing facet is not significantly related to other outcomes either, such as affective symptoms (Carpenter et al., 2019) and substance use behaviors (Karyadi et al., 2014).

Most importantly, the current study found that the associations between dispositional mindfulness and self-compassion with loneliness were significantly mediated by rejection sensitivity. Previous studies have only reported significant correlations among mindfulness, self-compassion, rejection sensitivity, and loneliness. On one hand, the results of the current research supported the findings of these studies. On the other hand, for the first time, we found that rejection sensitivity might be a mechanism of action explaining how and why dispositional mindfulness and self-compassion could alleviate loneliness, going beyond previous findings.

Theoretical and practical implications

The mediating effects found in the current study have important implications at both the theoretical and practical levels. At the theoretical level, the findings suggest that reduced rejection sensitivity may be a mechanism underlying the effects of mindfulness and self-compassion on loneliness. At the practical level, this finding may provide a potential direction for improving existing mindfulness and self-compassion training programs to maximize their effects on loneliness. However, to pursue such an avenue, the results of this study must first be confirmed in experimental studies. In fact, if these results are confirmed in future studies, practitioners can target rejection sensitivity when designing mindfulness and self-compassion interventions for loneliness. For example, psychoeducation on rejection sensitivity and its potential impact on loneliness can be incorporated into the protocol of these interventions. Practitioners implementing mindfulness-based interventions could encourage participants to monitor and accept their anxious expectations of rejection and their oversensitivity to social rejection cues in a non-reactive and non-judgmental manner. This could decrease negative feelings or behaviors (e.g., aggression or

social withdrawal) in social interactions during which participants perceive rejection. Similarly, interventions based on self-compassion could encourage participants to use self-compassion skills to cope with emotional, cognitive, and behavioral reactions related to rejection sensitivity during daily interactions.

Limitations and future research directions

Several limitations of the current research should be acknowledged. First, this study used a cross-sectional design, which prevents us from inferring causal relationships between variables. In the future, researchers may conduct longitudinal and intervention (i.e., experimental) studies to confirm the mediation models. Second, the variables in this study were all assessed via self-report measures, which may be subject to the influence of various response biases (e.g., socially desirable responding; Paulhus & Vazire, 2007). Future studies could incorporate neural correlates as objective measures of rejection sensitivity. For example, left inferior and right dorsal frontal regions were significantly less activated in individuals with high scores on rejection sensitivity compared to those with lower scores while viewing rejection versus acceptance images, and activities in these regions were negatively associated with participants' distress (Kross et al., 2007). Future studies could explore whether neural correlates of rejection sensitivity can mediate the relationship between dispositional mindfulness or self-compassion with loneliness. Third, although we did not restrict our sample to young adults, the data collected in our study was mostly from that age (mean age was 24.32), which may limit the generalizability of our findings to all adults. Previous studies suggest that older adults may also suffer from rejection sensitivity (Kang & Chasteen, 2009). Therefore, future studies should replicate these findings in older adults. In addition, the independent variables of the study (i.e., mindfulness and self-compassion) and the outcome (i.e., loneliness) were all associated with other mental health problems (e.g., depression; Carpenter et al., 2019; Erzen & Çikrikci, 2018; MacBeth & Gumley, 2012). As the current study did not measure other mental health symptoms, we cannot rule out their potential confounding effect. Future studies can examine the mediation models tested in the current study while controlling for other mental health problems (e.g., depression).

Conclusion

Apart from the limitations, the current study was a first attempt to investigate rejection sensitivity as a potential mechanism that explains the relationship between mindfulness and self-compassion with loneliness. The findings of the current study may inform future practitioners on how to

maximize the effects of self-compassion and mindfulness-based interventions on loneliness (i.e., by targeting rejection sensitivity).

Data availability statements The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval Approval was obtained from the ethics committee of McGill University. The procedures used in this study adhere to the tenets of the Declaration of Helsinki.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish The authors affirm that human research participants provided informed consent for publication of data in this study.

Conflicts of interest/Competing interests The authors have no relevant financial or non-financial interests to disclose.

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