

Reciprocal Relationship between Emotion Regulation Strategies and Depressive Mood: An Ecological Momentary Assessment Study of High-Risk Young Adults

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This study examines the reciprocal relationship between emotion regulation strategies (ERS; e.g., rumination and experiential avoidance) and depressive mood; and, using ecological momentary assessment (EMA), investigates whether this within-person relationship varies depending on the level of baseline depression. Participants comprised 122 college students (96 females and 26 males) in South Korea, who were screened to ensure their risk status for depression. Following baseline assessment, participants were asked to engage in EMA that involved providing data on momentary ERS and depressive mood five times daily for seven consecutive days. Dynamic SEM analyses indicated that momentary ERS predicted subsequent increases in depressive mood after controlling for depressive mood at the previous time point. Depressive mood also predicted subsequent increases in momentary ERS after adjusting momentary ERS at the previous time point. The baseline depression significantly moderated the within-person relationship between momentary rumination and subsequent depressive mood, but not the relationship between experiential avoidance and depressive mood. This study extends previous literature on ERS in relation to depression by examining their potential bidirectional relationship and exploring baseline depression as potential between-person moderators.

Keywords: depression, rumination, experiential avoidance, ecological momentary assessment, depressive mood

Introduction

Depression is a highly prevalent mental disorder that contributes to severe levels of emotional distress and difficulties in daily functioning (Kessler et al., 2003). As earlier onset is known to be more detrimental to individuals compared to later onset (Zisook et al.,

2007), an important task is to elucidate risk mechanisms that underlie depression in early adulthood.

Furthermore, rumination and experiential avoidance, well-known as prominent emotion regulation strategies (ERS), have greater effects on psychological outcomes compared to other emotion regulation strategies (Kashdan et al., 2006; Zawadzki, 2015), highlighting the need to further elucidate how they may conjointly operate in everyday context to impact individuals' psychological experiences. In this study, we examined reciprocal associations between ERS and depressive mood using an ecologically sensitive design within a sample of young adults at risk for depression. We also explored whether this relationship might differ depending on the levels of pre-existing depression.

Rumination and experiential avoidance (EA) are major maladaptive ERS which have been well-established as correlates of

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maladaptive outcomes (Aldao et al., 2010). Specifically, rumination, defined as repetitive, passive thoughts on the causes, consequences, and symptoms of depression (Nolen-Hoeksema, 1991), has been recognized as a risk factor for depression. Rumination may exacerbate and prolong negative affect by amplifying negative thoughts (Lewis et al., 2015). Longitudinal studies have found that higher levels of rumination predicted greater severity of depressive symptoms and the onset of depressive disorder a year later (Nolen-Hoeksema, 2000; Wilkinson et al., 2013). EA is a process including excessively negative evaluation of unwanted emotions, thoughts, and sensations, followed by attempts to avoid these experiences—derived from the unwillingness to fully experience them (Hayes et al., 1996). EA is also a contributor to depression, as avoiding experiences can ironically increase the aversive internal states that individuals desire to avoid (Abramowitz et al., 2001). Indeed, EA was found to predict the onset and relapse of depressive disorder (Spinhoven et al., 2016), as well as higher levels of depressive symptoms (Moroz & Dunkley, 2019).

In addition to the notion of ERS as a risk factor for depression, depression may also impact ERS. Depressive symptoms may be a source of rumination, or increase individuals' experience of stressful events, subsequently increasing the likelihood of further rumination (Nolen-Hoeksema et al., 1999). Empirical studies have also found support for the role of depression as a predictor of rumination (Calvete et al., 2015; Huffziger et al., 2009). Although very few studies have investigated depression as a precedent to EA, we may speculate that individuals with depression are likely to have negative perspectives on their future, which might lead to pursuing more avoidant goals (Dickson & MacLeod, 2006). However, empirical studies have yielded mixed findings regarding the relationship between the role of depression as a predictor of EA (Berking et al., 2009; Spinhoven et al., 2014).

Several researchers have recently underscored the value of examining the relationship between ERS and depression as a dynamic process of individual's inner states that may undergo fluctuations within a short span in everyday contexts (Hjartarson et al., 2021; Wenze et al., 2018). Ecological Momentary Assessment (EMA), which involves measuring participants' current affect, state, and behavior multiple times a day, has been proposed as a useful method for examining dynamic processes of psychological

constructs (Shiffman et al., 2008). EMA is advantageous in collecting closer to real-time data on fast changing psychological experiences (e.g., emotion) in participants' natural environment (Ebner-Priemer & Trull, 2009).

EMA studies have investigated the association between ERS and fluctuating affect based on the close relationship between negative affect and depression (O'Neill et al., 2004; Yang & Shim, 2021). For example, momentary rumination predicted subsequent negative affect, which, in turn, predicted subsequent ruminative self-focus (Moberly & Watkins, 2008). Similarly, higher levels of EA predicted subsequent increases in negative mood, and higher negative mood in turn predicted more engagement in subsequent EA (Wenze et al., 2018). On the other hand, a recent study showed that negative affect predicted subsequent increases in momentary rumination, while the reverse was not supported (Hjartarson et al., 2021). Though a few studies addressed the relationship between negative affect and ERS, no studies have investigated the relationship between depressive mood and ERS through EMA.

Furthermore, there is a possibility that the association between ERS and depressive mood in daily contexts may be influenced by preexisting individual differences, such as depression. For example, in an EMA study, baseline depressive symptoms moderated the within-person relationship between negative affect and subsequent rumination such that higher levels of depression strengthened the association between negative affect and subsequent rumination (Hjartarson et al., 2021). Moreover, in a study with clinical and healthy control groups, the relationship between post-event rumination and subsequent negative affect was only significant in the depression group, but not in the control group (Ruscio et al., 2015). In addition, baseline depressive symptoms moderated the concurrent within-person relationship between stress and EA such that stronger association was observed for individuals with greater levels of depressive symptoms (Wenze et al., 2018).

As reviewed, although a number of studies have examined the relationship between ERS and depressive symptoms (Connolly & Alloy, 2017; Ruscio et al., 2015), few have investigated reciprocal processes between ERS and depressive mood that may naturally occur in everyday context. Furthermore, it is yet unclear if those associations may differ based on individuals' preexisting levels of depression. Therefore, using an ecologically sensitive design, the cur-

rent study aimed to investigate the reciprocal relationship between maladaptive ERS (i.e., rumination, EA) and depressive mood within a sample of young adults who are at higher risk for depression. We also explored if those processes may be affected by individual variations in baseline depression.

Methods

Participants and Procedures

Participants were 136 college students in South Korea, who were screened to ensure their risk status for depression (CES-D score > 16; Cho et al., 1998). Data from 14 participants were dropped from analysis due to their low compliance (i.e., participant's data available for fewer than 50% of EMA alerts). The resulting sample consisted of 122 participants (96 females, 26 males; mean age = 21.43 years, [$SD = 2.16$, Range = 18-29]). There was no significant difference ($t = 1.98$, n.s) in the level of baseline depression between the males ($M = 35.92$) and females ($M = 32.36$).

Participants who consented to the study initially engaged in baseline assessment in which they responded to questionnaires on demographic and pre-EMA individual characteristics (e.g., depression). For the EMA, participants received alerts 5 times a day for 7 consecutive days (i.e., a total of 35 alerts) to their smartphones. These text messages were sent automatically at quasi-random intervals during 12-hour period (e.g., 10:00 A.M.-10:00 P.M. at minimum of 120 minutes apart). After 30 minutes have passed since an alert was sent, participants received a reminder text message. Based on previous research (Ruscio et al., 2015), responses that were received up to one hour were counted as valid considering the potential for situational constraints, such as university lectures. For each alert, the participants were to visit an online link that contained items on momentary ERS (i.e., rumination, EA) and depressive mood. Participants were rewarded with KRW 10,000 for the baseline assessment. Participants who engaged in EMA received a basic payment of 30,000 won, and those who provided data for above 80% of total alerts received an additional 15,000 won. The study procedures were IRB approved by Sungkyunkwan University (IRB 2022-04-018).

Measures

Baseline depression. Baseline depression was assessed via Center for Epidemiologic Studies Depression Questionnaire developed by Radloff (1977) and validated in Korean by Chon et al. (2001). CES-D is a 20-item questionnaire for screening depressive symptoms in community samples. Each item is rated on a 4-point Likert scale ranging from 0 to 3. Total scores ranged from 0 to 60, with higher scores indicating higher levels of depressive symptoms. The Cronbach's α was .81 in this study.

Momentary depressive mood. For each EMA alert, participants rated their depressive mood using a visual-analogue scale (Yang & Shim, 2021). Visual-analogue scale consists of a horizontal line with two endpoints labeled at each end, each representing the absence and the maximum of the measured experience, respectively. In this study, participants were asked to indicate the degree of their current feelings of depressive mood on this horizontal line at each alert, ranging from 0 (not at all) to 10 (severe).

Momentary rumination. Momentary rumination, measured at every EMA alert, was assessed with 4 items from the Ruminative Response Scale (RRS; Treynor et al., 2003), consistent with previous EMA studies (Smith et al., 2021). Each item was rated on a 5-point Likert scale ranging from 1 (not at all) to 5 (extremely). Participants were asked to select the degree that best represents their current state for each item (e.g., "To what extent are you currently thinking about something negative that happened?"). The Cronbach's α was .85 in this study.

Experiential avoidance. Momentary EA was evaluated using an abbreviated version of Multi-dimensional Experiential Avoidance Questionnaires (MEAQ; Gamez et al., 2011). Participants selected the degree that best represents their current state for each item (e.g., "I'm avoiding doing something because it might make me feel badly.") on a 5-point scale ranging from 1 (strongly disagree) to 5 (strongly agree). The Cronbach's α was .72.

Statistical Analyses

Following preliminary analyses using IBM SPSS Statistics 21, Dynamic Structural Equation Modeling (DSEM) was used to analyze our hypothesized model using Mplus 8.7. DSEM offers an advantage of decomposing data into within-person and between-person components (Hamaker et al., 2018). Additionally, it allows for the

analysis of time-varying relationships between these components (Hamaker et al., 2018). Furthermore, DSEM is based on Bayesian estimation, making it possible to analyze numerous random effects (McNeish & Hamaker, 2020). Lastly, DSEM eliminates biases that may arise when lagged variables are used as predictors of autoregressive and cross-lagged effects (McNeish & Hamaker, 2020).

As shown in Figure 1, we examined reciprocal relationships between ERS and depressive mood, incorporating baseline depression as a potential moderator of those processes. The two types of ERS (i.e., rumination and EA) were analyzed in separate models. First, depressive mood at time t was predicted by ERS at time $t-1$, after controlling for previous depressive mood at time $t-1$. Second, ERS at time t was predicted by depressive mood at time $t-1$, after controlling for the previous ERS at time $t-1$. Depressive mood and ERS were decomposed into latent within- and between-person components. Baseline depression was examined as between-person moderator which influences person-specific autoregressive and cross-lagged relationship between ERS and depressive mood. The within-person components describe depressive mood and ERS of individual i at time t :

$$\begin{aligned} \text{DEP}_{ti} &= \mu_{\text{DEP},i} + \phi_{1i} (\text{DEP}_{t-1i}) + \phi_{3i} (\text{ERS}_{t-1i}) + \zeta_{1ti} \\ \text{ERS}_{ti} &= \mu_{\text{ERS},i} + \phi_{2i} (\text{ERS}_{t-1i}) + \phi_{4i} (\text{DEP}_{t-1i}) + \zeta_{2ti} \end{aligned}$$

DEP_{ti} and ERS_{ti} refer to depressive mood and ERS at time t for participant i , respectively. $\mu_{\text{DEP},i}$ and $\mu_{\text{ERS},i}$ refer to means of depressive mood, and ERS for individual i , respectively. The parameters ϕ_{1i} and ϕ_{2i} refer to autoregressive effects of depressive mood and ERS at time $t-1$ on time t , respectively. The parameters ϕ_{3i} and ϕ_{4i} refer to cross-lagged effects of ERS and depressive mood at time $t-1$ on each other at time t . The parameters ζ_{1ti} and ζ_{2ti} refer to residual innovations of depressive mood and ERS at time t . Both means and lagged parameters are allowed to vary across individuals. To estimate cross-level interaction effect, baseline depression was included on the between-person level and grand mean-centered for ease of interpretation. The level 2 model can be demonstrated as:

$$\begin{aligned} \mu_{\text{DEP},i} &= \gamma_{00} + \gamma_{01} (\text{Baseline DEP}_i) + u_{0i} \\ \mu_{\text{ERS},i} &= \gamma_{10} + \gamma_{11} (\text{Baseline DEP}_i) + u_{1i} \\ \phi_{1i} &= \gamma_{20} + \gamma_{21} (\text{baseline DEP}_i) + u_{2i} \\ \phi_{2i} &= \gamma_{30} + \gamma_{31} (\text{baseline DEP}_i) + u_{3i} \\ \phi_{3i} &= \gamma_{40} + \gamma_{41} (\text{baseline DEP}_i) + u_{4i} \\ \phi_{4i} &= \gamma_{50} + \gamma_{51} (\text{baseline DEP}_i) + u_{5i} \end{aligned}$$

The parameters $\gamma_{00}-\gamma_{10}$ refer to the average intercept of depressive mood and ERS across individuals, respectively, and $\gamma_{20}-\gamma_{50}$ refer to the average effect of autoregressive parameters. The parameters

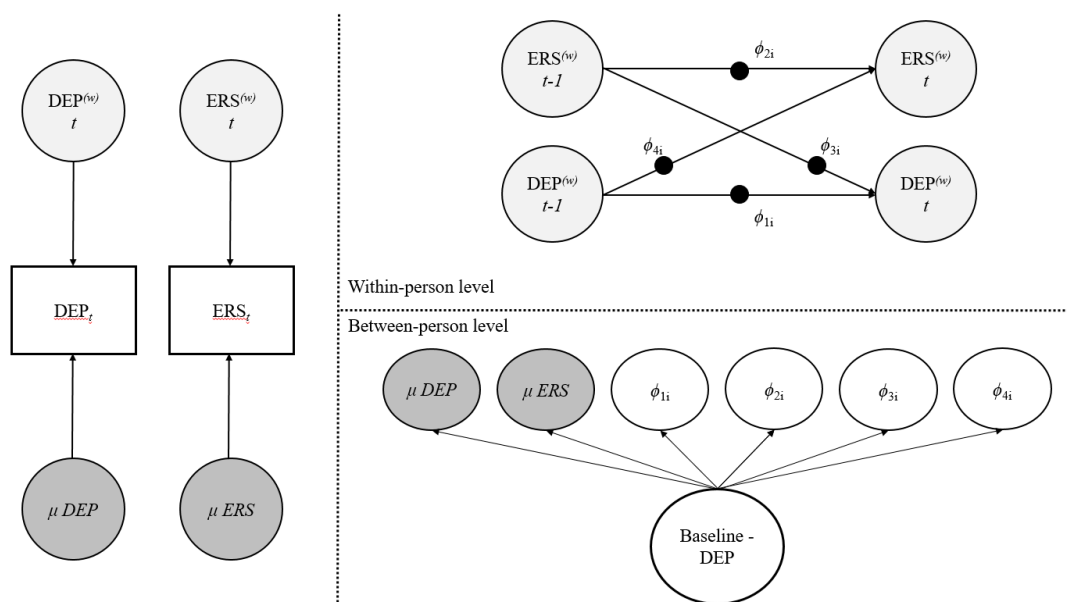


Figure 1. Multilevel cross-lagged model estimating the effects of baseline depression on the temporal relationship between momentary ERS and depressive mood. Black dots indicate random effects. (w) represent within-person estimates. ERS = momentary emotion regulation strategies; DEP = momentary depressive mood; μ = mean of within-person components (e.g., depressive mood, ERS) for individual; ϕ = lagged effect for individual.

ters γ_{40} – γ_{50} refer to the average effect of cross-lagged parameters. The parameters γ_{01} – γ_{51} refer to the predictors of person specific-means and the person specific-means of autoregressive and cross-lagged associations.

Results

Preliminary Analyses

Participants provided EMA data for a total of 4,039 alerts. Responses that were not received within 1 hour of alert, and data from participants who did not provide data for 50% or more of the total alerts were excluded from the analyses. Thus, a total of 3,642 alerts (91.17%) were analyzed. On average, each participant provided data from 29.85 alerts ($SD = 4.36$; Range = 18–35). The number of alerts for which each participant provided data was not significantly associated with age ($r = .15$; $p = .10$), gender ($t = -.51$; $p = .61$), or baseline depression ($r = .01$; $p = .96$). Participants' average levels of baseline depression were 33.12 ($SD = 8.22$), exceeding the cutoff point of 25 for severe depression (Cho et al., 1998). Intra-class correlations (ICC) of EMA measures were .42, .55, and .55 for momentary rumination, EA, and depressive mood, respectively. Descriptive statistics are presented in Table 1.

Reciprocal Relationship Between ERS and Depressive Mood: Within–Person Level

Standardized estimates and the visualization of parameters (i.e., effects and variances) are presented in Table 2 and Figure 1, respectively. For the model that included rumination and depressive mood, the autoregressive effect of depressive mood ($\phi_{DEP} \rightarrow DEP$; $B = 2.05$),

and momentary rumination ($\phi_{RUM} \rightarrow RUM$; $B = 2.10$) was significant, indicating that depressive mood and rumination tended to persist once initiated. Cross-lagged path from rumination at $t-1$ significantly predicted subsequent depressive mood at time t after controlling for previous depressive mood at time $t-1$ ($\phi_{RUM} \rightarrow DEP$; $B = 1.32$). In turn, depressive mood at $t-1$ to subsequent rumination at t was significant after adjusting previous rumination at time $t-1$ ($\phi_{DEP} \rightarrow RUM$; $B = 1.32$).

In the model that included EA and depressive mood, the autoregressive effect of depressive mood ($\phi_{DEP} \rightarrow DEP$; $B = 1.38$), and the autoregressive effect of EA ($\phi_{EA} \rightarrow EA$; $B = 1.13$) were both significant, indicating inertia of depressive mood and EA. In terms of cross-lagged effects, EA at time $t-1$ significantly predicted subsequent depressive mood at time t after controlling for depressive mood at time $t-1$ ($\phi_{EA} \rightarrow DEP$; $B = 0.69$). Depressive mood at $t-1$ also predicted subsequent EA at time t , after adjusting for the levels of previous EA at time $t-1$ ($\phi_{DEP} \rightarrow EA$; $B = 0.51$). In sum, ERS and depressive mood predicted each other at subsequent alerts, supporting a reciprocal association between ERS and depressive mood.

Effect of Baseline Depression on the Reciprocal Relationship between ERS and Depressive Mood: Between–Person Level

The average level of depressive mood during EMA was significantly associated with baseline depression in both models (μ_{DEP} ; $B_s = 0.43$ and 0.44 in the rumination model and EA model, respectively), indicating that participants who had higher levels of baseline depression exhibited, on average, higher levels of depressive mood during EMA. The average levels of momentary rumination and EA

Table 1. Descriptive Statistics and Bivariate Correlations

			1	2	3	4
Baseline measure	1	Depression	-	.32**	.32**	.39**
EMA measures	2	Rumination		-	.50**	.76**
	3	EA			-	.48**
	4	Depressive mood				-
<i>M</i>			33.12	2.82	3.12	4.16
<i>SD</i>			8.22	1.07	.89	2.57
Range			0–60	4–20	5–25	0–10
ICC				.42	.55	.55

$N = 122$.

* $p < .05$, ** $p < .01$.

Table 2. Reciprocal Association between Momentary ERS and Depressive Mood and the Moderating Effect of Baseline Depression

	Rumination				Experiential avoidance		
	B	SD	95% CI		B	SD	95% CI
Means				Means			
μ DEP	2.50	0.18	[2.15, 2.87]	μ DEP	2.51	0.19	[2.15, 2.91]
μ RUM	4.43	0.31	[3.75, 4.92]	μ EA	4.94	0.36	[4.25, 5.65]
Autoregression				Autoregression			
ϕ DEP $\rightarrow$ DEP	2.05	0.47	[1.42, 3.27]	ϕ DEP $\rightarrow$ DEP	1.38	0.21	[1.02, 1.85]
ϕ RUM $\rightarrow$ RUM	2.10	0.66	[1.36, 3.67]	ϕ EA $\rightarrow$ EA	1.13	0.18	[0.81, 1.53]
Cross-lagged slopes				Cross-lagged slopes			
ϕ RUM $\rightarrow$ DEP	1.32	0.56	[0.60, 2.87]	ϕ EA $\rightarrow$ DEP	0.69	0.26	[0.30, 1.31]
ϕ DEP $\rightarrow$ RUM	1.13	0.38	[0.53, 2.01]	ϕ DEP $\rightarrow$ EA	0.51	0.15	[0.23, 0.83]
Effect of baseline depression on				Effect of baseline depression on			
μ DEP	0.43	0.06	[0.32, 0.53]	μ DEP	0.44	0.06	[0.32, 0.54]
μ RUM	0.36	0.06	[0.24, 0.47]	μ EA	0.32	0.06	[0.20, 0.44]
ϕ DEP $\rightarrow$ DEP	-0.23	0.15	[-0.51, 0.06]	ϕ DEP $\rightarrow$ DEP	-0.01	0.09	[-0.19, 0.17]
ϕ RUM $\rightarrow$ RUM	0.26	0.17	[-0.06, 0.59]	ϕ EA $\rightarrow$ EA	0.17	0.09	[-0.00, 0.35]
ϕ RUM $\rightarrow$ DEP	0.55	0.24	[0.10, 0.98]	ϕ EA $\rightarrow$ DEP	0.14	0.13	[-0.11, 0.40]
ϕ DEP $\rightarrow$ RUM	-0.07	0.25	[-0.59, 0.41]	ϕ DEP $\rightarrow$ EA	0.03	0.10	[-0.16, 0.22]
Variances				Variances			
$\Psi\mu$ DEP	0.816	0.05	[0.72, 0.90]	$\Psi\mu$ DEP	0.81	0.05	[0.71, 0.90]
$\Psi\mu$ RUM	0.869	0.04	[0.78, 0.94]	$\Psi\mu$ EA	0.90	0.04	[0.81, 0.96]
$\Psi\phi$ DEP $\rightarrow$ DEP	0.949	0.07	[0.75, 1.00]	$\Psi\phi$ DEP $\rightarrow$ DEP	1.00	0.01	[0.96, 1.00]
$\Psi\phi$ RUM $\rightarrow$ RUM	0.930	0.10	[0.65, 1.00]	$\Psi\phi$ EA $\rightarrow$ EA	0.97	0.03	[0.88, 1.00]
$\Psi\phi$ RUM $\rightarrow$ DEP	0.693	0.69	[0.03, 0.99]	$\Psi\phi$ EA $\rightarrow$ DEP	0.98	0.05	[0.84, 1.00]
$\Psi\phi$ DEP $\rightarrow$ RUM	0.972	0.10	[0.63, 1.00]	$\Psi\phi$ DEP $\rightarrow$ EA	1.00	0.01	[0.95, 1.00]

Standardized effects are presented.

RUM = momentary rumination; EA = momentary EA; DEP = momentary depressive mood.

were significantly associated with baseline depression (μ RUM; $B = 0.36$, μ EA; $B = 0.32$), indicating that higher levels of baseline depression were related to higher average use of rumination and EA in everyday context. Next, baseline depression moderated the relationship between rumination at time $t-1$ and subsequent depressive mood at time t (ϕ RUM $\rightarrow$ DEP; $B = 0.55$). Specifically, higher levels of baseline depression were associated with stronger association between rumination and subsequent depressive mood in EMA. Conversely, baseline depression did not moderate the relationship between depressive mood at time $t-1$ and subsequent rumination at time t (ϕ DEP $\rightarrow$ RUM; $B = -0.07$). The moderation effects of baseline depression on both pathways (i.e., EA at time $t-1$ and subsequent depressive mood at time t , and vice versa) were not significant (ϕ EA $\rightarrow$ DEP; $B = 0.14$; ϕ DEP $\rightarrow$ EA; $B = 0.04$).

Discussion

This study examined the reciprocal relationship between ERS (i.e.,

rumination, experiential avoidance) and depressive mood in daily context using an EMA design within a college students at higher risk for depression. In addition, baseline depression was considered as a between-person factor moderating these reciprocal relationships. Results indicated that both types of ERS and depressive mood demonstrated bidirectional relationships over time. However, the effect of baseline depression on the within-person relationship between ERS and depressive mood varied depending on the type of ERS. The current study represents an initial effort to examining at-risk individuals' fluctuations in depressive mood using an ecologically valid design which differentiates this study from earlier studies on negative affect or mood (Moberly & Watkins, 2008; Wenzel et al., 2018).

We found that momentary increases in ERS and depressive mood were predictive of subsequent increases in depressive mood and ERS, respectively. The findings suggest that not only ERS, but also depressive mood may worsen subsequent mood by increasing engagement in dysfunctional ERS, which in turn contributes to

depressive mood. This finding is consistent with the notion that maladaptive ERS and depressive mood may contribute to a vicious cycle resulting in progressive exacerbation of mood over time (Moberly & Watkins, 2008). This may be attributed to the fact that the increased level of depressive mood triggered by maladaptive ERS may increase individuals' tendency to focus on the negative aspects of situations or themselves (Nolen-Hoeksema et al., 1999), thereby making it easier for them to engage in maladaptive ERS.

Additionally, baseline depression was found to strengthen the relationship between momentary rumination and subsequent depressive mood. This result may be understood in the context of the tendency of individuals with depression to be biased towards negative information (Donaldson et al., 2007), and to focus more on negative future events (Denson et al., 2012). Such tendency may intensify the effect of rumination on depressive mood as it may interfere with opportunities to consider other information that may be less negative. An earlier EMA study has also reported that higher levels of depressive symptoms intensified the concurrent association between rumination and negative affect (Moberly & Watkins, 2008). Using a lagged analysis, the current study provides a more rigorous test of the role of baseline individual differences (e.g., depression) on the processes by which rumination may impact later mood in daily context.

The baseline depression did not moderate the within-person relationship between momentary EA and subsequent depressive mood. This is consistent with a previous EMA study in which individual differences in depressive symptoms did not moderate the within-person relationship between EA and negative mood (Wenze et al., 2018). These findings may be attributed to the use of a non-clinical sample (Wenze et al., 2018). Additionally, while the current study was designed to measure ERS and depressive mood multiple times per day, the interval between measurements may have contributed to the lack of significant results.

This study offers clinical implications. Our findings provide empirical support for the Rumination-Focused CBT for the treatment for depression (Watkins, 2020). In Rumination-Focused CBT, patients learn about the role of rumination and problem-solving skills (Watkins, 2018). As a result, individuals become more able to redirect the focus of their thoughts and energy towards problem-solving instead of exacerbating negative thoughts

about oneself. An RCT study found that this treatment indeed reduced rumination which in turn resulted in decreases in depressive symptoms (Watkins et al., 2011). In addition, the observed associations between EA and depressive mood may provide empirical evidence supporting the effectiveness of Acceptance and Commitment Therapy (ACT). Specifically, ACT intervenes to individuals' negative evaluation of aversive inner states with a goal of helping them understand that those psychological experiences are not harmful but natural, thus do not need to be modified but accepted (Blackledge & Hayes, 2001). Individuals who receive ACT may break the link between depressive mood and EA, thereby pursuing their valued goals for better life (Hayes et al., 2006). Lastly, this study can help clients predict when rumination or experiential avoidance may occur in certain contexts. For instance, by helping clients recognize that depressive mood can serve as triggers for maladaptive ERS, they can be instructed to avoid automatically engaging in rumination and experiential avoidance when experiencing depressive mood (Wenze et al., 2018).

There are some limitations to note. First, this study included high-risk college students, limiting the generalizability of the findings to clinical and other community populations. Second, the EMA scales for rumination and experiential avoidance were based on prior literature (Smith et al., 2021; Wenze et al., 2018), but were not validated. Furthermore, this study assessed depressive mood with a single item due to reduce response burden which may not guarantee provision of comprehensive measurement. In future studies, it would be valuable to validate abbreviated questionnaire frequently used in EMA studies, including those related to emotion regulation and affective states. Third, although rumination and EA are two major dysfunctional ERS in relation to depression, future studies would benefit by encompassing both positive and negative ERS which could provide empirical data on which adaptive ERS to promote in intervention for individuals with depression. Fourth, cut-off of 16 points might not distinguish the probable depression within the current Korean population due to passage of time. Future studies may find it more appropriate to utilize a depression scale that has been recently validated in Korea.

Despite the limitations, the current study represents an initial effort to examine bidirectional processes between ERS and depressive mood in everyday context within a sample of young

adults at high risk for depression. These reciprocal relationships suggest that not only maladaptive ERS can be a trigger for depressive mood, but also depressive mood can be a risk factor for maladaptive ERS. Moreover, the findings suggest the importance of considering specific ERS in relation to depressive mood, and also the baseline individual variations in depression as a predictor of the association between daily dynamics between ERS and depressive mood. This study highlights the potential of effectively managing rumination and EA in the treatment of depression, particularly given the greater impact of rumination on depressive mood observed in our results. We hope that future studies may expand these findings by implementing EMA designs in treatment settings and exploring the effect of EMA variables on later depression.

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Author contributions statement

Jooyoung Jang, graduate student at Sungkyunkwan University, collected and analyzed data, and led manuscript preparation. Hy-ein Chang, associate professor at Sungkyunkwan University, supervised the entire research procedures and the write-up. All authors provided critical feedback, participated in revision of the manuscript, and approved the final manuscript.

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