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RUMINATION AS A TRANSDIAGNOSTIC RISK FACTOR TO PSYCHOPATHOLOGY

Theses of the Doctoral Dissertation

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1. GENERAL INTRODUCTION

People spend approximately one third to half of their time contemplating past events or future scenarios, the content of which can substantially affect their mood (Killingsworth & Gilbert, 2010; Song & Wang, 2012). Hence, these inner monologues are crucial components to our well-being, a prominent form of which is rumination. The earliest and most thoroughly researched definition of rumination, the Response Style Theory (Nolen-Hoeksema, 1991) defined rumination as the passive dwelling on the reasons, contexts, and implications of one's own depressive symptoms, also referred to as depressive rumination (Nolen-Hoeksema, 1991). Depressive rumination aggravates depressive symptoms among patients with affective disorders (Nolen-Hoeksema et al., 1993), as well as among non-clinical adults (Michl et al., 2013), and anticipates the onset and reoccurrence of depressive episodes of mood disorder patients (Nolen-Hoeksema et al., 2008).

The Goal Progress Theory (Martin & Tesser, 1996) advocates a wider approach to rumination, in which ruminative thoughts stem from unreached goals, and hence can emerge in relation to current or future events besides past experiences. According to this theory, state rumination will continue until the objective is either reached or discarded. This framework focuses less on the content and valence of ruminative thoughts, and more on their disruptive and uncontrollable aspect. The authors suggest that although ruminative thoughts may not be inherently negative, they may still increase negative emotions by serving as an intrusive, recurrent daily reminder of unfulfilled goals that may provoke feelings of inadequacy, anxiety, and depressed mood (Dickson et al., 2019).

Alloy et al. (2000) conceptualize rumination as a maladaptive thought process occurring in reaction to a stressful event. Rumination may intensify the perceived severity of the stressful situation and therefore may lead to an aggravated stress response and hamper adaptation, contributing to chronic stress (Gerin et al., 2012), reflecting that the mental representation and the attributed significance of stressors is crucial in adaptation (Del Giudice et al., 2011).

Initially, rumination has been investigated regarding depressed mood and major depression (Nolen-Hoeksema, 1991), but in the last two decades, it has been associated with several other psychological problems beyond depressed mood. Furthermore, it has been linked with several somatic complaints via the stress-disease association (Brosschot & Doef, 2006; Gerin et al., 2012; Williams et al., 2017). Thus, rumination is considered a transdiagnostic risk factor to psychopathology (Ehring & Watkins, 2008; Nolen-Hoeksema & Watkins, 2011). Transdiagnostic approaches aim to identify neurobiological, biopsychosocial, behavioral, and cognitive-emotional mechanisms that tend to be linked to a broad variety of psychiatric diagnoses (Dalgleish et al., 2020). Exploring these factors may aid in the investigation of the root causes behind the observed psychological symptoms linked with certain diagnostic categories, potentially leading to more precise diagnosis and more effective treatment (Sauer-Zavala et al., 2017). Therefore, they are of increasing importance in research and practice in clinical psychology and psychiatry (Insel et al., 2010).

In this dissertation we examined the associations between rumination and certain psychological problems from a transdiagnostic perspective. We carried out four empirical studies that are summarized in Table 1.1. and are outlined one by one thereafter.

Study	**Validating the Hungarian RTSQ (Study 1)**	**Rumination in MDD and BD – meta-analysis (Study 2)**	**PO level, symptoms of BPD and depression (Study 3)**	**Perceived stress and rumination in COVID-19 among migraineurs and HCs (Study 4)**
Background	• Inconclusive results about the factor structure of RTSQ • the psychometric properties of the Hungarian RTSQ have not been studied	• ER processes are crucial in mood disorders • The importance of rumination has gained empirical support in both MDD and BD	• The role of rumination in borderline & depressive symptoms, as well as the connection between PO and borderline & depressive symptoms is well-established • The mediating role of rumination between PO and symptoms have not been studied elsewhere	• Migraine patients may be at higher risk of developing stress-related symptoms during times of chronic stress (i.e., COVID-19) due to their higher stress reactivity • Rumination may exacerbate the importance of the perceived stressor, leading to elevated distress
Theoretical framework	Goal Progress Theory	Response Styles Theory	Response Styles Theory, Emotional Cascade Model	Rumination in response to a stressor
Aims/ research questions	Validating the Hungarian RTSQ	Is there a difference in rumination among BD and MDD patients?	Exploring whether rumination mediates the relationship between PO level and rumination	Does rumination explain perceived stress in migraine patients and HCs? Is this association stronger among migraineurs than HCs?
Sample	Young adult N=1123; N=320	Clinical adult, k=12, N=2071	Young adult, N=179, N=261	Migraineur (N=73) and HC (N=64) adult
Procedure	Cross-sectional self-report survey method	meta-analysis	Cross-sectional self-report survey method	

Table 1.1. Summary of the four studies.
Note. RTSQ = Ruminative Thought Style Questionnaire, MDD = major depressive disorder, BD = bipolar disorder, PO = personality organization, BPD = borderline personality disorder, HC = healthy control.

2. VALIDATING THE BIFACTOR STRUCTURE OF THE RUMINATIVE THOUGHT STYLE QUESTIONNAIRE - A PSYCHOMETRIC STUDY (STUDY 1)[1]

2.1. Aims

The earliest and most thoroughly researched definition of rumination, the Response Style Theory (Nolen-Hoeksema, 1991) defined rumination in response to one's own depressed mood. However, subsequent findings revealed that rumination is not restricted to depression and should rather be considered a transdiagnostic risk factor to psychopathology – thus, the need for self-report measures that conceptualize rumination more broadly emerged. The Goal Progress Theory (Martin & Tesser, 2006) offers a broader framework, as it emphasizes the importance of the intrusive and irrepressible nature of ruminative thoughts rather than their content. Based on this theory, the Ruminative Thought Style Questionnaire (RTSQ), a self-report scale was created, aiming to assess rumination as a general thinking style, unbiased by depressive symptoms (Brinker & Dozois, 2009). Thus, in our first study we examined the factor structure of the Hungarian RTSQ, as previous research about its psychometric properties reported inconclusive results. We also aimed to test the gender invariance of the best fitting model, and test its construct validity with the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) and the Brief Symptom Inventory (BSI) (Derogatis, 1993; Derogatis & Melisaratos, 1983). In a second study we tested its convergent validity compared to the Ruminative Response Scale (RRS)(Treynor et al., 2003) and its construct validity compared to the Zung Self-rating Depression Scale (ZSDS) on an independent sample. Considering previous theoretical and empirical work (Mihić et al., 2019) we hypothesized positive associations between the RTSQ and the reflective pondering and brooding factors of the RRS.

2.2. Study 1

2.2.1. Methods of Study 1

Sample and Procedure

Two independent researchers translated the RTSQ from English to Hungarian. Differences were resolved by discussion and consensus with the help of a third native Hungarian-speaking researcher who used to live in an English-speaking country for years. Then a fourth researcher backtranslated the Hungarian version to English. A native English-speaking psychologist reviewed the two versions and found that the backtranslation adequately reflected the meaning of the original items.

Data collection was carried out within the framework of a larger research project (Kotyuk et al., 2019). Ethical consent was obtained from the Scientific and Research Ethics Committee

[1] Kovács, L. N.*, Kocsel, N.*, Galambos, A., Magi, A., Demetrovics, Z., & Kökönyei, G. (2021). Validating the bifactor structure of the Ruminative Thought Style Questionnaire—A psychometric study. *PLOS ONE, 16*(7), e0254986. https://doi.org/10.1371/journal.pone.0254986

of the Medical Research Council (ETT TUKEB) for the whole research project including this study. Written informed consent of participants was obtained. Students were recruited from several university dormitories, who participated in the study on a voluntary basis. Inclusion criteria were age of 18 years or older and active student status at the university, no further restrictions applied. The final sample comprised of 1123 students (55% female; N= 618), where the minimum age was 18, the maximum 37 years (M= 21.96; SD=1.96).

Measures

Ruminative Thought Style Questionnaire (RTSQ) (Brinker & Dozois, 2009). RTSQ is a 20-item self-report scale that is aiming to measure rumination regardless of the valence, temporal orientation, or content of such thoughts. Participants have to respond on a 7-point Likert-scale. The RTSQ total score has shown excellent internal consistency (Cronbach $\alpha = .89 – .92$) and high test-retest reliability after two weeks ($r = .80$, $p < .01$) (Brinker & Dozois, 2009), as well as its subscales suggested by Tanner et al. (2013)(Cronbach $\alpha = .71- .89$).

The Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977). The CES-D has been designed for measuring depressive mood in the general population (Radloff, 1977). The original 20-item instrument was shortened to eight negative affect items and two positive affect items. Participants are asked to evaluate on a four-point Likert scale from *0=never* to *3=always* how often they felt this way during the last seven days.

The Brief Symptom Inventory (BSI) (Derogatis, 1993; Derogatis & Melisaratos, 1983) primarily aims to measure psychological symptoms of clinical patients. The BSI is the shortened form of the Derogatis Symptom Checklist (SCL-90) (Derogatis, 1975) that consists of nine subscales, measuring symptom domains on a five-point Likert scale ranging from *0=not at all to 4=extremely*. The mean score of the 53 items is referred to as the General Symptom Index (GSI). We only included the GSI in our analyses based on previous recommendations (Urbán et al., 2014).

Data analysis strategy

The degree of fit of three prior measurement models were estimated, namely: 1) one factor model proposed by the authors of the RTSQ (Brinker & Dozois, 2009) (Model 1); 2) the second-order four-factor solution found by Tanner and colleagues (Tanner et al., 2013) (Model 2); 3) and the bifactor model of Mihić and colleagues, where almost every item (except Item 16) loaded to the general rumination factor, but several items were left out of group factors due to low factor loadings (i.e.: items 5,10,14,15,18)(Mihić et al., 2019)(Model 3). Multiple fit indices were considered to evaluate model fit.

We tested a bifactor ESEM on the bifactor model proposed by Mihić et al (Mihić et al., 2019), i.e., we formulated one general factor and four specific factors (*Problem-focused thoughts:* Items 9,11,12,13*; Counterfactual thinking:* Items 6-8*; Repetitive thoughts:* Items 1-4*; Anticipatory thoughts:* Items 17,19,20). After a thorough content check, we also decided to leave out Item 16 *("I like to sit and think about pleasant events from the past."*), which is in line with previous recommendations (Mihić et al., 2019; Tanner et al., 2013). In the bifactor ESEM (Model 4), items loaded on their main factors, but cross-loadings were allowed (targeted, but not forced to be zero).

Then, we tested the gender invariance of the best fitting model using a multigroup approach. Finally, correlation analyses with CES-D and BSI were conducted to test the construct validity of the RTSQ.

2.2.2. Main Results of Study 1

Comparing measurement models

Table 2.1. shows the fit indices for each model. Model 1 did not fit the data, while both Model 2 and Model 3 indicated unsatisfactory fit. The only acceptable model was Model 4, implying that the variance was best explained by a bifactor ESEM structure, where 14 out of 19 items loaded on the subfactors besides the general factor.

Table 2.1. Factor analyses of four measurement models of the Ruminative Thought Style Questionnaire.

	AIC/BIC	χ^2	df	CFI	TLI	RMSEA	90% CI	SRMR
Model 1	80702.246/ 81003.672	2579.555	170	.699	.663	.112	.11-.12	.079
Model 2	58942.291/ 59188.455	576.214	86	.916	.897	.071	.07-08	.059
Model 3	74569.131/ 74925.818	865.870	138	.906	.883	.069	.06-.07	.047
Model 4	74008.382/ 74626.304	318.861	86	.970	.940	.049	.04-.06	.020

Model 1= One factor CFA; Model 2=Second-order four factor CFA; Model 3= bifactor CFA; Model 4= bifactor ESEM; AIC, Akaike Information Criteria; BIC, Bayesian Information Criterion, χ^2, chi-square test statistic; df, degree of freedom; CFI, Comparative Fit Index; TLI, Tucker-Lewis Index; RMSEA, Root Mean Squared Error of Approximation; CI, confidence interval; SRMR, Standardized Root Mean Square Residual.

The Cronbach αs of the total score of the RTSQ and its subscales demonstrated good internal consistency, in line with previous findings. The omega total of the RTSQ was .939 and the omega hierarchical coefficient for the whole scale was .851, indicating that only 15% of the total score variance was attributable to the group factors.

Based on the CFI and RMSEA delta values, the bifactor ESEM demonstrated configural, metric, scalar, strict and variance-covariance invariance, supporting the measurement invariance of RTSQ across gender. In line with our expectations, the RTSQ showed significant positive correlation both with the CES-D (r = .46) and the BSI scores (r = .53).

2.3. Study 2

2.3.1. Methods of Study 2

Sample and Procedure

In Study 2, our primary goal was to test the construct validity of the RTSQ to support the findings of Study 1. Undergraduate psychology students were recruited in exchange for partial class credit. Eligibility criteria included being 18 years old or older with no previous history of mental or neurological illness. The students completed self-report questionnaires online in the computer lab within a bigger study framework for 45 minutes. The study was approved by the Institutional Review Board of the Faculty of Education and Psychology, Eotvos Lorand University, and data collection was carried out in accordance with the Declaration of Helsinki. Participation in the study was voluntary and anonymous, and written informed consent was obtained. 320 participants (268 females; mean age=23.28, SD=2.93 years) were included for analysis.

Measures

Ruminative Response Scale (RRS) (Treynor et al., 2003)]. The RRS contains 10 items rated on a four-point Likert scale from *1 = never to 4 =always*, forming two subscales labelled brooding and reflective pondering. Reflective pondering is a more adaptive way of repetitive thought processing (at least in long-term), where analyzing one's own emotions and thoughts may facilitate problem solving, while brooding can be characterized as the passive, self-criticizing dwelling on past stressful situations (Treynor et al., 2003).

The **Zung Self-rating Depression Scale** (ZSDS) (Simon, A, 1998; Zung, 1965) was used to measure depressive symptoms. The ZSDS is a 20-item instrument where each item is rated on a 4-point scale (*1= a little of a time; 4=most of the time*). The total score (ranged between 20-80) of ZSDS was calculated and used in the analysis, where higher scores indicates more depressive symptoms.

RTSQ described above was also used in Study 2.

Statistical analysis

Pearson correlation analyses were applied to test the construct validity of the RTSQ. We examined the factor structure of the RTSQ the same way as we did in Study 1.

2.3.2. Main Results of Study 2

Similarly to Study 1, the bifactor ESEM showed good fit to the data in Study 2 (χ^2=169.632, df=86, CFI=.96, TLI=.93, RMSEA=.06, SRMR=.03). The RTSQ showed significant positive correlations with the ZSDS total score (r = .58), was weakly associated with reflective pondering (r= .23) but showed stronger positive correlations with brooding (r= .60). No significant gender differences were found.

2.4. Discussion

The results of Study 1 suggest that the factor structure of the RTSQ is best described with a 19-item bifactor Exploratory Structural Equation Modelling (ESEM), where most of the variance is explained by the general factor. The model was found to be invariant across genders. The correlations in Study 2 demonstrated that the RTSQ is congruent with the RRS, and that rumination captured by the RTSQ is rather maladaptive, as it was more strongly associated with the brooding subscale of the RRS than with reflective pondering. Significant positive associations were found with depressive symptoms and psychopathology in general, reaffirming its validity. Our results support that RTSQ assesses rumination globally, and it is a valid measure of ruminative thinking style that is rather negatively valenced but does not solely focus on depressive mood and symptoms, thus it is a valid and reliable rumination measure that can be used in transdiagnostic research.

3. RUMINATION IN MAJOR DEPRESSIVE AND BIPOLAR DISORDER – A META-ANALYSIS (STUDY 2)[2]

3.1. Aims

While depressed, patients with major depressive disorder (MDD) and bipolar disorder (BD) appear to ruminate on negative mood, while BD patients tend to engage in rumination on positive affect in [hypo]mania (Ghaznavi & Deckersbach, 2012). Therefore, rumination may lead to increased vulnerability to emotional disturbances by magnifying the significance of emotionally relevant events, regardless its valence (Alloy et al., 2009). The current study attempted to examine rumination among the two patient groups with meta-analytic techniques. Based on previous findings, we hypothesized that both patient groups tend to engage in depressive rumination without significant differences, whereas we expected that BD patients report more rumination on positive affect. The effects of potential moderators were also assessed.

3.2. Methods

The full study protocol was pre-registered and is available at Open Science Framework (https://osf.io/hjenm). We searched for studies that investigated rumination in both BD and MDD in the following databases: PubMed, Science Direct, Web of Science and EBSCO in May 2019. The reference lists of the identified articles, as well as of relevant reviews and metaanalyses (Dodd et al., 2019; Ghaznavi & Deckersbach, 2012; Silveira & Kauer-Sant'Anna, 2015) were also screened. We only included empirical studies that recruited a group of patients formally diagnosed with BD, a group of patients formally diagnosed with MDD, and contained

[2] Kovács, L. N., Takacs, Z. K., Tóth, Z., Simon, E., Schmelowszky, Á., & Kökönyei, G. (2020). Rumination in major depressive and bipolar disorder—A meta-analysis. *Journal of Affective Disorders, 276*, 1131–1141. https://doi.org/10.1016/j.jad.2020.07.131

at least one rumination measure. After removing duplicates, 488 studies remained, on which we conducted an initial screening process based on title and abstract. During this initial screening 331 studies were excluded. The full texts of the remaining 157 articles were reviewed by two researchers independently to determine which articles should be included. During this process, we identified 12 studies with an overall sample size of 2071 clinical patients (n of BD patients= 671, n of MDD patients= 1400). The identified articles were coded by two researchers independently. Coders resolved any disagreements by discussion.

We conducted the analyses with the Comprehensive Meta-Analysis (CMA) Version 3 (Borenstein et al., 2006). First, the standardized mean difference (Hedges's g) between the BD and the MDD patient groups on the rumination subscales were calculated. A positive effect size indicated that the BD group was more prone to rumination, while a negative effect suggested that the MDD group reported more rumination. Studies with a standardized residual exceeding ±3.29 were considered outliers (Tabachnick & Fidell, 2012). We compared the two patient groups regarding gender ratio and mean age with t-tests using IBM SPSS Software Version 25.0 (IBM Corp., Armonk, NY). We conducted meta-regression analyses to assess the impact of potential confounds. Publication bias was assessed with the help of the Egger's test and funnel plots including Duval and Tweedie's trim-and-fill method (Duval & Tweedie, 2000; Egger et al., 1997). In case of significant average effect sizes, Rosenthal's fail-safe *n* was also calculated (Rothstein et al., 2005).

3.3. Main Results

We ran several meta-regressions to assess the impact of potential confound variables: publication year (β = 0.056, p= 0.11, k = 12), gender ratio of BD group (β = -1.76, p= 0.33, k=9), gender ratio of MDD group (β = -1.53, p= 0.31, k = 9), difference in the percentage of females (β = -3.17, p= 0.27, k = 11), age of BD group (β = 0.003, p= 0.79, k = 9) age of MDD group (β = 0.002, p= 0.83, k = 9), and quality score (β = -0.13, p= 0.07, k = 12), none of which were significant.

We conducted a meta-analysis including all rumination measures to test whether there was a significant difference between the ruminative tendencies of the two patient groups in general. As Figure 3.1 demonstrates, we did not find a significant difference (*g* =0.16, *k*=12, SE=0.11, 95% CI [-0.06, 0.38], *p* =0.16).

Study name	Comparison	Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Taylor Tavares (2007)	Blank	RRS (RSQ) total (22 items)	-0,686	0,326	0,106	-1,325	-0,048	-2,107	0,035
Wolkenstein (2014)	Blank	CERQ rumination subscale	-0,216	0,216	0,046	-0,639	0,207	-1,002	0,317
Kearns (2016)	Blank	Combined	-0,148	0,238	0,056	-0,614	0,318	-0,622	0,534
Forgeard (2018)	Blank	Combined	-0,115	0,157	0,025	-0,423	0,194	-0,729	0,466
Batmaz (2014)	Blank	Leahy Emotional Schema Scale rumination subscale	-0,105	0,115	0,013	-0,329	0,120	-0,915	0,360
Liu (2009)	Blank	RRS (RSQ) total (22 items)	-0,046	0,138	0,019	-0,316	0,224	-0,331	0,741
Fletcher (2013)	Combined	Combined	0,170	0,145	0,021	-0,114	0,454	1,175	0,240
Gilbert (2013)	Blank	Combined	0,305	0,252	0,064	-0,189	0,800	1,210	0,226
Weinstock (2018)	Blank	Combined	0,476	0,259	0,067	-0,031	0,984	1,840	0,066
Kim (2012)	Blank	RRS (RSQ) total (22 items)	0,583	0,153	0,023	0,283	0,883	3,813	0,000
Hanssen (2018)	Combined	Combined	0,624	0,174	0,030	0,284	0,964	3,597	0,000
Yavuz (2016)	Blank	RTSQ	0,844	0,190	0,036	0,472	1,216	4,447	0,000
			0,159	0,113	0,013	-0,062	0,380	1,407	0,159

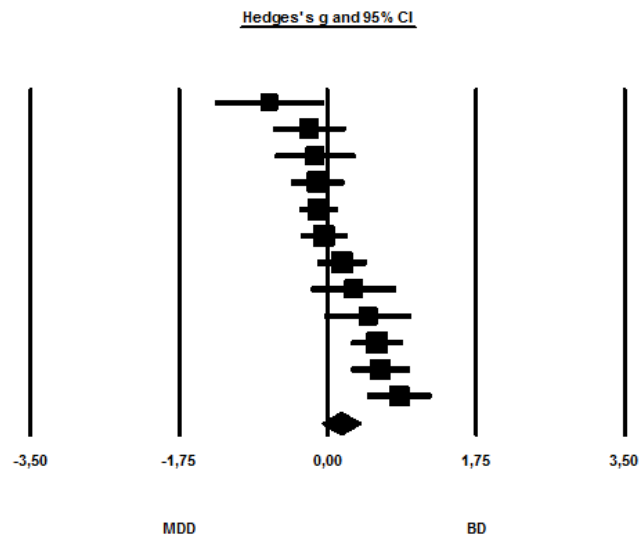

Figure 3.1. Forest plot for rumination in BD compared to MDD.

We conducted four additional meta-analyses, one for each rumination subtype (depressive rumination, rumination on positive affect, reflection, rumination not further specified). The results are summarized in Table 3.1.

Table 3.1. Meta-analyses according to rumination subtype.

		Effect size and 95% confidence interval					Heterogeneity				
Rumination subtype	k	Hedges's g	SE	CI	Z	p	Q	df	p	I^2	Fail-safe N
depressive rumination	7	0.03	0.13	-0.23-0.30	0.26	0.80	22.11	6	<0.01	72.86	-
rumination on positive affect	4	0.46	0.10	0.28-0.65	4.88	<0.00	1.67	3	0.64	0.00	20
reflection	1	0.04	0.16	-0.27-0.35	0.27	0.79	0.00	0	1.00	0.00	-
rumination not further specified	4	0.08	0.22	-0.36-0.51	0.34	0.74	23.37	3	<0.01	87.17	-

Note. Random models. Positive Hedges's g values indicate BD group mean > MDD group mean.

As hypothesized, we could not find significant difference between the two patient groups in terms of depressive rumination in the seven available studies. However, as expected, based on the four relevant studies the BD group reported more rumination on positive affect. The results are demonstarted in Figure 3.2.

Study name	Comparison	Outcome	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Gilbert (2013)	Blank	Combined	0,305	0,252	0,064	-0,189	0,800	1,210	0,226
Fletcher (2013)	Combined	Combined	0,379	0,145	0,021	0,094	0,664	2,608	0,009
Weinstock (2018)	Blank	Combined	0,537	0,260	0,068	0,027	1,046	2,065	0,039
Hanssen (2018)	Combined	Combined	0,624	0,174	0,030	0,284	0,964	3,597	0,000
			0,463	0,095	0,009	0,277	0,649	4,879	0,000

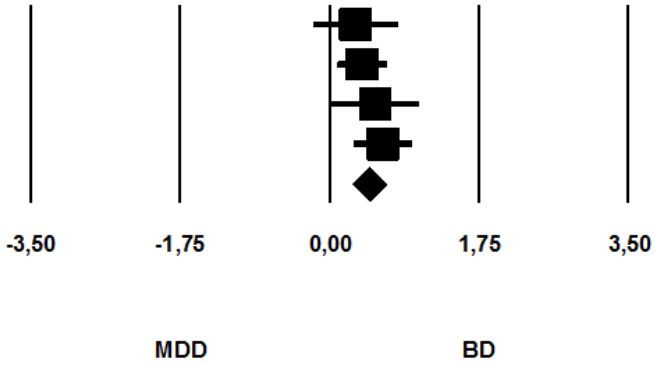

Figure 3.2. Forest plot for rumination on positive affect in BD compared to MDD.

Since the BD group reported more rumination on positive affect than the MDD group, we explored whether this difference remains significant when testing for the two BD subgroups separately. Our results supported that both BD-I ($g=0.51$, $k=4$, $SE=0.086$, 95% CI [0.34, 0.68], $p<0.01$]) and BD-II patients ($g=0.44$, $k=2$, $SE=0.12$, 95% CI [0.21, 0.67], $p<0.01$) reported more rumination on positive affect than MDD patients, with similar moderate effect sizes.

We aimed to test whether the current mood state of MDD patients (depressed vs. remitted) and BD patients (depressed/manic/remitted) moderated the difference in rumination between the two patient groups, however, most of the studies ($k=8$) did not delineate the current episode of patients, therefore these moderation analyses could not be performed.

3.4. Discussion

Some authors argue that mood disorders only differ in the severity of certain symptoms based on which they constitute a continuum, whereas others posit that they should be considered categorical as they differ qualitatively in their neuropsychological background. Therefore, studies examining cognitive-emotional phenomena such as rumination among both MDD and BD patients are of great relevance. According to our knowledge, this is the first meta-analysis to compare rumination in BD and MDD.

Our findings suggest that rumination is present transdiagnostically among both MDD and BD subjects, and that these patients may not differ in terms of depressive rumination, which they most probably experience during their depressive episodes. Rumination on positive affect mainly characterizes BD patients and appears to be linked with disturbed reward processing experienced in [hypo]mania. However, more studies are needed to be able to draw conclusions regarding the connection between current mood state/episode of illness and state rumination, which could also yield important insights about plausible interventions to reduce rumination in the different phases of mood disorders. Such interventions appear to have utmost importance in BD-I, as these patients experience the most severe affective symptoms in both directions, and therefore tend to ruminate the most.

4. RUMINATION MEDIATES THE RELATIONSHIP BETWEEN PERSONALITY ORGANIZATION AND BORDERLINE-DEPRESSIVE SYMPTOMS (STUDY 3)[3]

4.1. Aims

Rumination may aggravate symptoms of borderline personality disorder (BPD) (e.g. Peters et al., 2014; Selby & Joiner, 2009). According to the Emotional Cascade Model, negative events evoke negative emotions that in return trigger a ruminative response, which then intensifies the negative perception of the original stressful situation, leading to even more

[3] Kovács, L. N., Schmelowszky, Á., Galambos, A., & Kökönyei, G. (2021). Rumination mediates the relationship between personality organization and symptoms of borderline personality disorder and depression. *Personality and Individual Differences, 168*, 110339. https://doi.org/10.1016/j.paid.2020.110339

rumination (Selby & Joiner, 2009), especially among BPD patients, who lack constructive emotion regulation strategies (Dixon-Gordon et al., 2017; Linehan, 1993; Links et al., 2007), resulting in an emotionally escalating vicious circle that is difficult to terminate. According to the model, impulsive behavior represents the person's attempt to interrupt the cascade (Baer et al., 2012). Empirical investigations of the Emotional Cascade Model suggest that rumination mediates the relationship between emotion dysregulation and impulsive behavior among BPD patients (Martino et al., 2015) and non-clinical adults (Selby et al., 2008).

In Kernberg's (1993) psychodynamic model the term borderline describes one of the three levels of personality organization (PO) that fall out of the range of mental well-being; the other two levels are psychotic and neurotic. According to this model, three ego-functions determine the level of PO: identity diffusion, primitive defense, and reality testing. Borderline personality disorder, together with most personality disorders, falls to the borderline level of personality organization (BPO)(Hilsenroth et al., 2003). Affective lability, negative emotions and impulsive behavior, features that have been robustly associated with rumination, are key components of the entire BPO level and are not specific to BPD (Kernberg & Caligor, 2005). Therefore, we suggested that the Emotional cascade model may not only characterize BPD patients but may be plausible to the whole BPO level. Thus, we proposed that rumination may mediate the relationship between PO level and symptoms of borderline personality disorder and its frequent concomitant, depressed mood (American Psychiatric Association, 2013). We also conducted a second study to replicate the findings of our mediation model on a community sample that is more heterogeneous in terms of age and education, and to see whether brooding, the maladaptive facet of rumination is a stronger mediator than reflection.

4.2. Study 1

4.2.1. Materials and Methods of Study 1

Sample and procedure

The work has been carried out in accordance with the Declaration of Helsinki. After obtaining the ethical consent of the Institutional Review Board, we conducted two self-report studies on non-clinical samples. Informed consent of was acquired. Participants who have never been diagnosed by any psychiatric or neurological diseases were included in the study. In the first study, we recruited university students (n= 179) who received partial course credit for participating. The sample was predominantly female (84.9%; n = 152). The minimum age was 20, the maximum 43 years (M= 24.35; SD=3.23).

Measures

Ruminative Thought Style Questionnaire (RTSQ, Brinker & Dozois, 2009) is a self-report survey of 20 items that is aiming to assess rumination globally, without specifying the valence, content and temporal orientation of ruminative thoughts. Participants have to answer on a 7-point Likert-scale.

Borderline Symptom List (BSL-23, Bohus et al., 2009) is the shortened version of BSL-95, a self-report survey that aims to measure BPD symptoms based on the diagnostic criteria of

DSM-IV. Participants are asked to indicate on a five-point Likert scale whether they experienced symptoms often reported by BPD patients during the previous week.

Inventory of Personality Organization (IPO, Kernberg & Clarkin, 1995) is a 57-item questionnaire based on Kernberg's model of PO. Each statement is rated on a 5-point Likert-scale from 1 (never true) to 5 (always true). The IPO contains three subscales, identity diffusion (ID), primitive defense (PD) and reality testing (RT), corresponding to the personality functions described by Kernberg (1993). The three scales are intercorrelated, especially ID and PD, as they both reflect the ego functions characteristic of the BPO level, i.e. of personality disorders (Lenzenweger et al., 2001). Furthermore, the two-factor model where ID and PD load on a single factor appears to represent the latent structure of the IPO better than considering the three subscales separate (Smits et al., 2009). This is in line with Kernberg's model (1993), where PD and ID are strongly associated theoretical constructs and both represent the BPO spectrum, while RT characterizes the psychotic level.

The Center for Epidemiologic Studies Depression Scale (CES-D, Radloff, 1977) assesses depressive symptoms in the general population (Radloff, 1977). It is a short self-report measure made up of 20 items investigating depressed mood during the past week, each of which is evaluated on a four-point Likert scale.

Statistical analysis

We carried out structural equation modelling with MPlus software (Version 8, Muthen & Muthen, 1998) to test whether the connection between PO level, and symptoms of BPD and depression is mediated by rumination, as measured by the RTSQ. PO level was used as a single latent variable indexing the two subscales of IPO that are associated with personality disorder symptoms, ID and PD. Gender and age were controlled for in the model.

Main Results of Study 1

In the first study, our mediation model showed an excellent model fit ($\chi^2 = 8.034$, df = 6, RMSEA = 0.044 [0.000-0.113], SRMR = 0.040, CFI = 0.996, TLI = 0.986). Rumination was a weak but significant mediator between PO level and BPD (standardized indirect effect: .092, p = .033; proportion mediated = 0.14), as well as between PO level and depressive symptoms (standardized indirect effect: .108, p = .049; proportion mediated = 0.20). The total explained variance of BPD symptoms were 46.5% ($p < .001$), whereas the total explained variance of depressive symptoms were 33.3% ($p < .001$). The model is shown in Figure 4.1.

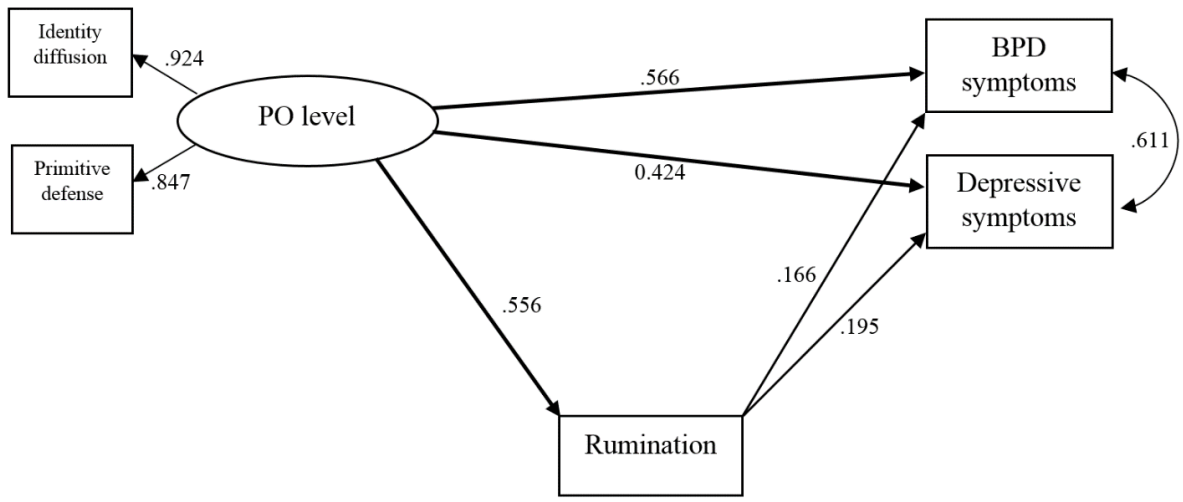

Figure 4.1. The mediation model of Study 1 and its standardized path coefficients.
Note: All drawn paths are significant at p < .001, except between rumination and depressive symptoms (p = .038), and rumination and BPD symptoms (p= .035). PO = Personality Organization, BPD = Borderline Personality Disorder. Gender and age were controlled for in the model.

4.3. Study 2

4.3.1. Materials and Methods of Study 2

Sample and Procedure

We recruited our participants (n= 261) with convenience sampling method online via social media posts. Informed consent was acquired. Participants who have never been diagnosed by any psychiatric or neurological diseases were included in the study. 67% of the participants (n= 175) were women. The minimum age was 18, the maximum 68 years (M=37.91; SD= 11.51).

Measures

We measured rumination with the 10-item version of the **Ruminative Response Scale** (RRS, Treynor et al., 2003) that contains two subscales, brooding and reflective pondering. Items of the RRS are rated on a four-point Likert scale from 1 (never) to 4 (always). Brooding can be characterized as a self-criticizing thinking style that focuses on past negative experiences. Reflective pondering, on the other hand, is a rather adaptive way of repetitive thinking where one is trying to understand their own emotional processes.

We assessed borderline symptoms with BSL-23, depressive symptoms with CES-D, and PO level with the ID and PD subscales of the IPO questionnaire, all of which have been described in Study 1.

Statistical Analysis

In Study 2, we assumed that brooding is a stronger mediator of the association between PO level and borderline-depressive symptoms than reflective pondering. We carried out structural equation modelling to test this hypothesis. PO level was used as a single latent variable indexing ID and PD subscales. Gender and age were controlled for in the model.

4.3.2. Main Results of Study 2

The relative goodness of fit indices showed good model fit for the mediation model of the second study (χ^2=22.543, df=7, RMSEA=0.092 [0.051-0.136], SRMR=0.059, CFI=0.982, TLI=0.931). Our results showed that both brooding and reflective pondering mediated the relationship between personality functioning and symptoms of BPD and depression, and in line with our expectations, this association was stronger for brooding. The total explained variance of depressive symptoms was 47.1% ($p < .001$), the total explained variance of BPD symptoms was 58.9% ($p < .001$). The model is shown in Figure 4.2.

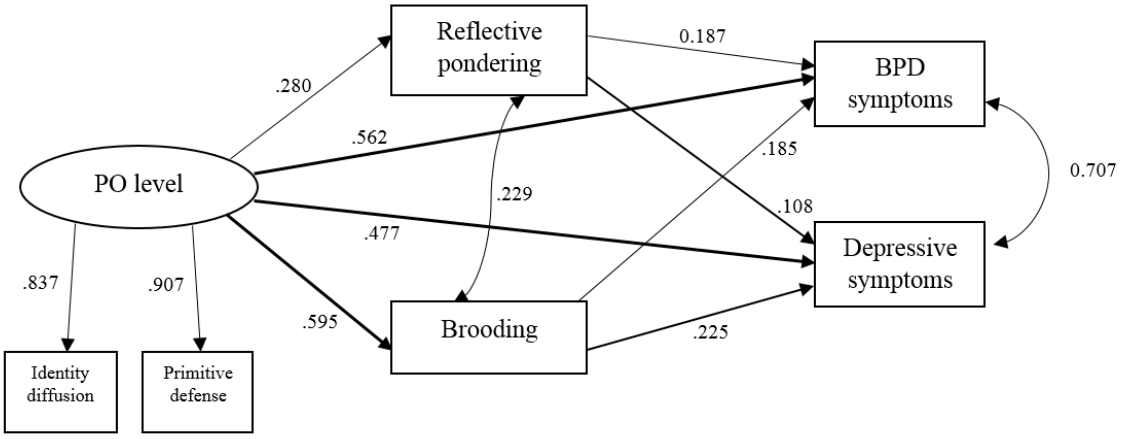

Figure 4.2. The mediation model of Study 2 and its standardized path coefficients.
Note: All drawn paths are significant at p ≤.01, except between reflective pondering and depressive symptoms (p=.032). Gender and age were controlled for in the model.
PO=Personality Organization, BPD=borderline personality disorder.

4.4. Discussion

Rumination is a transdiagnostic mediator that may bridge certain personality features with the occurrence of clinical symptoms. In this study we examined whether rumination mediated the relationship between personality structure and symptoms of BPD and depression, an association that has not been studied elsewhere. In Study 1, we examined the reported associations on a sample of university students, while in Study 2 we wished to replicate our findings on a more heterogeneous community sample and extend it by assessing the mediating

role of brooding and reflective pondering separately. Rumination mediated the relationship between PO level and disorder-specific symptoms in both studies, implying that when low personality functioning is accompanied by rumination, this maladaptive emotion regulation strategy may exacerbate symptoms of BPD and depression. This association was stronger for brooding, the maladaptive facet of rumination than for reflective pondering. The relationship between personality structure deficits, maladaptive emotion regulation strategies such as rumination, and symptoms of BPD and depression should be further explored to better understand their role in the emergence of psychological disorders, and to be able to design more effective means of prevention and intervention.

5. PERCEIVED STRESS IN THE TIME OF COVID-19: THE ASSOCIATION WITH BROODING AND COVID-RELATED RUMINATION IN ADULTS WITH AND WITHOUT MIGRAINE (STUDY 4)[4]

5.1. Aims

Elevated levels of psychological stress and negative mental health outcomes evoked by COVID-19 and related restrictions have been reported extensively worldwide (e.g. Husky et al., 2020; Rajkumar, 2020; Rehman et al., 2021; Rossi et al., 2020; Salari et al., 2020; Vindegaard & Benros, 2020; Xiong et al., 2020; Ye et al., 2020). Migraine is a stress-related condition, where acute stress is a prevalent migraine trigger, and migraine attacks and deriving disability may further increase stress (Sauro & Becker, 2009). Due to this multidirectional relationship, migraineurs may be especially vulnerable to stressors related to the COVID-19 pandemic. Rumination can be considered a maladaptive stress response that may exacerbate the perceived importance of the stressor, leading to elevated stress (Aldao et al., 2010). Therefore, we tested (1) whether the level of perceived stress was higher among migraine patients than HCs; (2) whether being a migraine patient and the tendency to engage in rumination predicted perceived stress; (3) and whether the association between perceived stress and rumination will be stronger among migraineurs than HCs.We assessed two different types of rumination, brooding, a maladaptive, self-criticizing facet of depressive rumination (Treynor et al., 2003), as well as ruminating about the COVID-19 pandemic and related measures.

5.2. Methods

5.2.1. Sample and Procedure

Data was collected in May-June 2020. We contacted 311 people who had participated in previous studies between 2014-2019 and agreed to be approached for future research. Inclusion criteria for these previous studies included aged between 18 and 50 years, and no history of

[4] Kovács, L. N., Baksa, D., Dobos, D., Eszlári, N., Gecse, K., Kocsel, N., Juhász, G., & Kökönyei, G. (2021). Perceived stress in the time of COVID-19: The association with brooding and COVID-related rumination in adults with and without migraine. *BMC Psychology, 9*(1), 68. https://doi.org/10.1186/s40359-021-00549-y

severe somatic, neurological, or psychological problems – except migraine - or psychotropic medication. Participants who fulfilled these criteria attended a medical examination by a headache specialist, who established the diagnosis of episodic migraine without aura (IHS, 2013). We sent the link of the study to 311 potential respondents in e-mail. Participation was anonymous and voluntary, informed consent was acquired. The final sample comprised of 62 healthy controls (HC) and 70 migraineurs. The sample was predominantly female (73.5%; n= 97). The minimum age was 20, the maximum 50 years (M= 30.76; SD= 7.10). The original study, as well as the current data acquisition was approved by the Scientific and Research Ethics Committee of the Medical Research Council (Hungary) and is in accordance with the Declaration of Helsinki.

5.2.2. Measures

Demographic data (gender, age, education), and potential confounding factors related to the pandemic (whether participants had to quarantine/them or their close family members tested positive to COVID-19/lost a relative or close acquaintance due to COVID-19) were assessed.

The 10-item **Ruminative Response Scale** (RRS; (Treynor et al., 2003) was used to measure depressive rumination, where respondents are instructed to evaluate their repetitive thinking style when feeling sad or depressed. The RRS contains two subscales, brooding and reflection, each measured by 5 items rated on a four-point Likert scale from 1 (never) to 4 (always). Brooding is considered a maladaptive, often self-blaming aspect of repetitive thinking about stressful life event. Reflection, on the other hand, is a more constructive way of rumination that may facilitate problem solving (Joormann et al., 2006).

The four-item **Perceived Stress Scale** (PSS-4; S. Cohen et al., 1983) was used to measure how participants appraised their own levels of stress since the appearance of the COVID-19 pandemic in Hungary. Items are rated on a five-point Likert scale ranging from 0 to 4.

COVID-related Rumination Scale (CRS) consisted of four items retrieved from the Post-event processing questionnaire (PEPQ; (Rachman et al., 2000) that measures repetitive thoughts after a stressful social situation. The instruction and the wording of the items were tailored to focus on the content of repetitive thinking regarding COVID-19. Participants were instructed to think about the current COVID-19 situation and related events (e.g., reports on new cases and mortality) and restrictive measures and indicate to what extent have they experienced ruminative thoughts related to them.

The **Migraine Disability Assessment** (MIDAS; Stewart et al., 2000) questionnaire was used to measure the burden caused by headache. Scores of the first five items of the scale was summed for each participant to capture headache-related disability (e.g., missed days and/or reduced productivity in work/school, household, and social activity due to headache) in the last three months. We assessed the MIDAS among HCs as well and asked them to answer these questions regarding their headaches in general (if they had any).

5.2.3. Statistical analyses

We conducted a multiple linear regression to test whether depressive rumination – especially brooding – and rumination specific to COVID-19 (measured by the CRS) explained perceived stress during the times of the coronavirus, after controlling for gender, age, headache

status (i.e. migraine/HC group), disability due to headache (i.e. the MIDAS score). We also aimed to test whether there was an interaction between brooding and headache status regarding perceived stress, for which we centered the brooding variable.

5.2.4. Main Results

We performed Spearman correlations of the assessed measures for the total sample and for the migraine and HC group separately. Non-parametric correlations were applied due to the non-normality of the variables. The results are summarized in Table 5.1.

Table 5.1. Spearman correlations of the assessed measures for the total sample and for the migraine and control group separately.

	Total sample n=132				Migraine group n=70				Control group n=62			
	RRS r.	CRS	PSS	MIDAS	RRS r.	CRS	PSS	MIDAS	RRS r.	CRS	PSS	MIDAS
RRS b.	.27**	.24**	.49**	-.04	.28*	.30*	.58**	-.14	.27*	.13	.41**	-.24
RRS r.		-.01	.08	.05		-.07	.05	.04		.06	.12	.02
CRS			.32**	.06			.44**	.03			.12	-.23
PSS				.13				-.02				.21

*Note. *p<0.05; **p<0.01. RRS b. = Ruminative Response Scale brooding subscale, RRS r. = Ruminative Response Scale reflection subscale, CRS = COVID-related Rumination Scale, PSS = Perceived Stress Scale, MIDAS = Migraine Disability Assessment.*

As Table 5.1 demonstrates, COVID-related rumination correlated with perceived stress and brooding only in the migraine group. We found a tendency-level difference in the correlation coefficients in case of brooding and perceived stress (Z=1.27, p=.10), and significant difference in case of COVID-related rumination and perceived stress (Z=1.97, p=.02), where the association was stronger in the migraine group (r = .44, p < .01) than among HCs (r = .12, p = .37).

Multiple linear regression was used to test whether rumination specific to COVID-19 and depressive rumination (i.e., brooding and reflection) explained perceived stress, after controlling for gender, age, headache status and disability caused by headache. As presented in Table 5.2, more brooding and COVID-related rumination predicted higher levels of perceived stress. We did not find significant interaction between rumination and headache status. The total explained variance of the regression model was 31.3% (R^2=.313; *df*=130).

Table 5.2. Multiple linear regression model with subtypes of rumination explaining perceived stress, after controlling for gender, age, headache status and headache disability.

Predictors	β	*p*	R^2
Gender	-.039	.644	
Age	.009	.909	
Migraine/HC	.042	.650	
MIDAS	.125	.155	
CRS	.255	.002	
RRS brooding	.373	.002	
RRS reflection	-.053	.512	
RRS brooding * Migraine/HC	.105	.365	.313

Note. n=132. RRS = Ruminative Response Scale, CRS = COVID-related Rumination Scale, PSS = Perceived Stress Scale, MIDAS = Migraine Disability Assessment.

5.3. Discussion

Our results demonstrated that COVID-related rumination and brooding appear to be associated with higher level of perceived stress, underlining that rumination may exacerbate the importance of the stressor and therefore amplify and prolong stress response, hence it can be considered a transdiagnostic risk factor to stress-related psychological and psychosomatic problems (Brosschot et al., 2006; Ottaviani et al., 2016). Although we did not find any difference in the level of perceived stress among migraineurs and the control group, perceived stress was more strongly associated with brooding as well as COVID-related rumination among migraineurs than healthy controls, hinting at the increased vulnerability of this patient group in stressful situations like the COVID-19 pandemic. However, the regression analysis did not support this result, thus it should be replicated on a bigger sample. Our results also suggest that ruminating about the pandemic and its consequences is weakly associated with trait-level depressive rumination, thus may be more contingent on other specific factors.

6. GENERAL DISCUSSION

There is an ongoing transition in the way we think about mental health, shifting from the dichotomist view of being sick versus being healthy to a dimensional perspective of mental strengths and weaknesses, giving rise to examining transdiagnostic factors that may underlie several diagnostic categories (Cuthbert, 2014). This paradigm shift is important in reducing the stigma around mental illness by openly accepting that most people experience psychological problems to some extent during their lives, rather than distinguishing the "mentally ill" from the "mentally healthy". In order to facilitate the transition towards an empirically tested diagnostic system with a dimensional approach, the National Institute of Mental Health (NIMH) initiated the Research Domain Criteria (RDoC) project that supports research related to transdiagnostic variables, providing data that enables the revision of the current diagnostic systems (Insel et al., 2010). Rumination, together with other emotion regulation strategies, has been identified as one such transdiagnostic factor that merits further investigation (Fernandez et al., 2016).

Throughout the studies presented in this dissertation, we examined rumination from a transdiagnostic perspective, focusing on certain aspects of this repetitive maladaptive emotion regulation strategy. As rumination widely characterizes nonclinical populations and the associated negative outcomes are not limited to clinical patients (e.g., Moulds et al., 2007; Wahl et al., 2011; E. R. Watkins et al., 2005), it is important to examine it among community samples. Furthermore, university students appear to be characterized by elevated risk for poor mental health, risky behavior, depressive symptoms, and suicidal ideation (Kadison & DiGeronimo, 2004), hence examining rumination, a potential risk factor for these symptoms, could be of great relevance for this population. In this dissertation we carried out four studies recruiting university students and adult community samples that are summarized in Table 6.1., together with their main findings and limitations.

Study	**Validating the Hungarian RTSQ (Study 1)**	**Rumination in MDD and BD – meta-analysis (Study 2)**	**PO level, symptoms of BPD and depression (Study 3)**	**Perceived stress and rumination in COVID-19 among migraineurs and HCs (Study 4)**
Aims/ research questions	Validating the Hungarian RTSQ	Is there a difference in rumination among BD and MDD patients?	Exploring whether rumination mediates the relationship between PO level and BPD & depressive symptoms	Does rumination explain perceived stress in migraine patients and HCs? Is this association stronger among migraineurs than HCs?
Theoretical framework	Goal Progress Theory	Response Styles Theory	Response Styles Theory, Emotional Cascade Model	Rumination in response to a stressor
Conclusions	• The Hungarian RTSQ is a valid rumination measure • The total score is more reliable than the subscales • Captures the maladaptive aspect of rumination globally, not only regarding depressive symptoms	• Rumination is a significant process in both MDD and BD • Rumination subtype is an important moderator • Our synthesis highlights methodological limitation of the field, e.g., heterogeneity in reporting clinical data	• Rumination plays an important role in the emotion dysregulation and negative affectivity of individuals with lower PO • Treatments to reduce rumination can contribute to treatment efficacy in a wide range of mental disorders	• Vulnerability of migraine patient group in stressful situations like COVID-19 • Chronic stressors like the pandemic might trigger rumination even in individuals who otherwise do not ruminate
Limitations	• Disproportionate gender distribution in Study 2 (male<female) • Cannot account for cultural and language differences between various translations	• Specific scope → few studies qualified → limited applicability • The role of rumination in mood disorders and should also be examined longitudinally	• Convenience sampling → upper domain of PO & few BPD symptoms • Cross-sectional self-report survey method → biases, cannot infer causality	• Small sample size • Specific scope → limited applicability • Cross-sectional self-report survey method → biases, cannot infer causality

Table 6.1. Summary of the main conclusions of the four studies.
Note. RTSQ = Ruminative Thought Style Questionnaire, MDD = major depressive disorder, BD = bipolar disorder, PO = personality organization, BPD = borderline personality disorder, HC = healthy control.

In sum, our studies demonstrated that rumination is an important transdiagnostic risk factor that can be related to a wide array of psychological problems, such as depressive symptoms and psychopathology in general (Study 1), BD and MDD (Study 2), low PO, borderline and depressive symptoms (Study 3), and perceived stress (Study 4). Among these results, our study was the first to

1) test the psychometric properties of the Hungarian RTSQ and its criterion validity to depression and psychopathology;

2) systematically compare rumination in BD and MDD with meta-analysis;

3) test the associations between PO level and rumination;

4) explore rumination and perceived stress among migraineurs during COVID-19.

Furthermore, these studies demonstrated that brooding, the maladaptive, self-deprecating aspect of rumination showed a stronger relationship with psychopathology than other subtypes of rumination such as reflection or COVID-related rumination. This underlines the need to subdivide rumination to key components and examine which aspects are especially maladaptive, as it could also yield better psychoeducational and psychotherapeutic intervention techniques (E. R. Watkins & Roberts, 2020).

The main limitation of these studies are the self-report survey methods prone to bias, with cross-sectional designs that do not enable to infer causation, and limited generalizability due to the specific scope and non-representative samples. Their main strength is the transdiagnostic, transtheoretical framework, and answering novel research questions, that should be extended in scope and replicated with more ecologically valid methods and potentially representative samples in the future.

REFERENCES

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review*, *30*(2), 217–237. https://doi.org/10.1016/j.cpr.2009.11.004

Alloy, L. B., Abramson, L. Y., Flynn, M., Liu, R. T., Grant, D. A., Jager-Hyman, S., & Whitehouse, W. G. (2009). Self-focused cognitive styles and bipolar spectrum disorders: Concurrent and prospective associations. *International Journal of Cognitive Therapy*, *2*(4), 354–372. https://doi.org/10.1521/ijct.2009.2.4.354

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (Fifth Edition). American Psychiatric Association. https://doi.org/10.1176/appi.books.9780890425596

Baer, R. A., Peters, J. R., Eisenlohr-Moul, T. A., Geiger, P. J., & Sauer, S. E. (2012). Emotion-related cognitive processes in borderline personality disorder: A review of the empirical literature. *Clinical Psychology Review*, *32*(5), 359–369. https://doi.org/10.1016/j.cpr.2012.03.002

Bohus, M., Kleindienst, N., Limberger, M. F., Stieglitz, R.-D., Domsalla, M., Chapman, A. L., Steil, R., Philipsen, A., & Wolf, M. (2009). The short version of the Borderline Symptom List (BSL-23): Development and initial data on psychometric properties. *Psychopathology*, *42*(1), 32–39. https://doi.org/10.1159/000173701

Borenstein, M., Hedges, L. V., Higgins, J. P. T., & Rothstein, H. R. (2006). *Comprehensive meta-analysis* (3.0) [Computer software]. Biostat.

Brinker, J. K., & Dozois, D. J. A. (2009). Ruminative thought style and depressed mood. *Journal of Clinical Psychology*, *65*(1), 1–19. https://doi.org/10.1002/jclp.20542

Brosschot, J. F., & Doef, M. van der. (2006). Daily worrying and somatic health complaints: Testing the effectiveness of a simple worry reduction intervention. *Psychology & Health*, *21*(1), 19–31. https://doi.org/10.1080/14768320500105346

Brosschot, J. F., Gerin, W., & Thayer, J. F. (2006). The perseverative cognition hypothesis: A review of worry, prolonged stress-related physiological activation, and health. *Journal of Psychosomatic Research*, *60*(2), 113–124. https://doi.org/10.1016/j.jpsychores.2005.06.074

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, *24*(4), 385–396. https://doi.org/10.2307/2136404

Cuthbert, B. N. (2014). The RDoC framework: Facilitating transition from ICD/DSM to dimensional approaches that integrate neuroscience and psychopathology. *World Psychiatry*, *13*(1), 28–35. https://doi.org/10.1002/wps.20087

Dalgleish, T., Black, M., Johnston, D., & Bevan, A. (2020). Transdiagnostic Approaches to Mental Health Problems: Current Status and Future Directions. *Journal of Consulting and Clinical Psychology*, *88*(3), 179–195. https://doi.org/10.1037/ccp0000482

Del Giudice, M., Ellis, B. J., & Shirtcliff, E. A. (2011). The Adaptive Calibration Model of stress responsivity. *Neuroscience and Biobehavioral Reviews*, *35*(7), 1562–1592. https://doi.org/10.1016/j.neubiorev.2010.11.007

Derogatis, L. R. (1975). *The Symptom Checklist-90-R (SCL-90-R)*. http://ubir.buffalo.edu/xmlui/handle/10477/1885

Derogatis, L. R. (1993). *BSI, Brief Symptom Inventory: Administration, scoring & procedures manual*. National Computer Systems.

Derogatis, L. R., & Melisaratos, N. (1983). The Brief Symptom Inventory: An introductory report. *Psychological Medicine*, *13*(3), 595–605. https://doi.org/10.1017/S0033291700048017

Dickson, J. M., Moberly, N. J., & Huntley, C. D. (2019). Rumination selectively mediates the association between actual-ideal (but not actual-ought) self-discrepancy and anxious and depressive symptoms. *Personality and Individual Differences*, *149*, 94–99. https://doi.org/10.1016/j.paid.2019.05.047

Dixon-Gordon, K. L., Peters, J. R., Fertuck, E. A., & Yen, S. (2017). Emotional Processes in Borderline Personality Disorder: An Update for Clinical Practice. *Journal of Psychotherapy Integration*, *27*(4), 425–438. https://doi.org/10.1037/int0000044

Duval, S., & Tweedie, R. (2000). Trim and fill: A simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, *56*(2), 455–463. https://doi.org/10.1111/j.0006-341x.2000.00455.x

Egger, M., Smith, G. D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, *315*(7109), 629–634. https://doi.org/10.1136/bmj.315.7109.629

Fernandez, K. C., Jazaieri, H., & Gross, J. J. (2016). Emotion Regulation: A Transdiagnostic Perspective on a New RDoC Domain. *Cognitive Therapy and Research*, *40*(3), 426–440. https://doi.org/10.1007/s10608-016-9772-2

Gerin, W., Zawadzki, M. J., Brosschot, J. F., Thayer, J. F., Christenfeld, N. J. S., Campbell, T. S., & Smyth, J. M. (2012). Rumination as a Mediator of Chronic Stress Effects on Hypertension: A Causal Model. *International Journal of Hypertension*, *2012*. https://doi.org/10.1155/2012/453465

Ghaznavi, S., & Deckersbach, T. (2012). Rumination in bipolar disorder: Evidence for an unquiet mind. *Biology of Mood & Anxiety Disorders*, *2*, 2. https://doi.org/10.1186/2045-5380-2-2

Hilsenroth, M. J., Segal, D. L., & Hersen, M. (Eds.). (2003). *Comprehensive Handbook of Psychological Assessment, Volume 2: Personality Assessment* (1 edition). Wiley.

Husky, M. M., Kovess-Masfety, V., & Swendsen, J. D. (2020). Stress and anxiety among university students in France during Covid-19 mandatory confinement. *Comprehensive Psychiatry*, *102*, 152191. https://doi.org/10.1016/j.comppsych.2020.152191

Insel, T., Cuthbert, B., Garvey, M., Heinssen, R., Pine, D. S., Quinn, K., Sanislow, C., & Wang, P. (2010). Research domain criteria (RDoC): Toward a new classification

framework for research on mental disorders. *The American Journal of Psychiatry*, *167*(7), 748–751. https://doi.org/10.1176/appi.ajp.2010.09091379

Joormann, J., Dkane, M., & Gotlib, I. H. (2006). Adaptive and Maladaptive Components of Rumination? Diagnostic Specificity and Relation to Depressive Biases. *Behavior Therapy*, *37*(3), 269–280. https://doi.org/10.1016/j.beth.2006.01.002

Kadison, R., & DiGeronimo, T. F. (2004). *College of the overwhelmed: The campus mental health crisis and what to do about it* (pp. vi, 296). Jossey-Bass.

Kernberg, O. F. (1993). *Severe Personality Disorders: Psychotherapeutic Strategies* (Reprint edition). Yale University Press.

Kernberg, O. F., & Caligor, E. (2005). A Psychoanalytic Theory of Personality Disorders. In *Major theories of personality disorder, 2nd ed* (pp. 114–156). Guilford Press.

Killingsworth, M. A., & Gilbert, D. T. (2010). A Wandering Mind Is an Unhappy Mind. *Science*, *330*(6006), 932–932. https://doi.org/10.1126/science.1192439

Kotyuk, E., Farkas, J., Magi, A., Eisinger, A., Király, O., Vereczkei, A., Barta, C., Griffiths, M. D., Kökönyei, G., Székely, A., Sasvári-Székely, M., & Demetrovics, Z. (2019). The psychological and genetic factors of the addictive behaviors (PGA) study. *International Journal of Methods in Psychiatric Research*, *28*(1), e1748. https://doi.org/10.1002/mpr.1748

Linehan, M. M. (1993). *Cognitive-behavioral treatment of borderline personality disorder* (pp. xvii, 558). Guilford Press.

Links, P. S., Eynan, R., Heisel, M. J., Barr, A., Korzekwa, M., McMain, S., & Ball, J. S. (2007). Affective Instability and Suicidal Ideation and Behavior in Patients with Borderline Personality Disorder. *Journal of Personality Disorders*, *21*(1), 72–86. https://doi.org/10.1521/pedi.2007.21.1.72

Martin, L. L., & Tesser, A. (1996). Some ruminative thoughts. In *Ruminative thoughts* (pp. 1–47). Lawrence Erlbaum Associates, Inc.

Martin, L. L., & Tesser, A. (2006). Extending the Goal Progress Theory of Rumination: Goal Reevaluation and Growth. In *Judgments over time: The interplay of thoughts, feelings, and behaviors* (pp. 145–162). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195177664.003.0009

Martino, F., Caselli, G., Berardi, D., Fiore, F., Marino, E., Menchetti, M., Prunetti, E., Ruggiero, G. M., Sasdelli, A., Selby, E., & Sassaroli, S. (2015). Anger rumination and aggressive behaviour in borderline personality disorder. *Personality and Mental Health*, *9*(4), 277–287. https://doi.org/10.1002/pmh.1310

Michl, L. C., McLaughlin, K. A., Shepherd, K., & Nolen-Hoeksema, S. (2013). Rumination as a Mechanism Linking Stressful Life Events to Symptoms of Depression and Anxiety: Longitudinal Evidence in Early Adolescents and Adults. *Journal of Abnormal Psychology*, *122*(2), 339–352. https://doi.org/10.1037/a0031994

Mihić, L., Novović, Z., Lazić, M., Dozois, D. J. A., & Belopavlović, R. (2019). The Dimensions of Ruminative Thinking: One for All or All for One. *Assessment*, *26*(4), 684–694. https://doi.org/10.1177/1073191117694747

Moulds, M. L., Kandris, E., Starr, S., & Wong, A. C. M. (2007). The relationship between rumination, avoidance and depression in a non-clinical sample. *Behaviour Research and Therapy*, *45*(2), 251–261. https://doi.org/10.1016/j.brat.2006.03.003

Nolen-Hoeksema, S. (1991). Responses to depression and their effects on the duration of depressive episodes. *Journal of Abnormal Psychology*, *100*(4), 569–582. https://doi.org/10.1037//0021-843x.100.4.569

Nolen-Hoeksema, S., Morrow, J., & Fredrickson, B. L. (1993). Response styles and the duration of episodes of depressed mood. *Journal of Abnormal Psychology*, *102*(1), 20–28. https://doi.org/10.1037//0021-843x.102.1.20

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking Rumination. *Perspectives on Psychological Science: A Journal of the Association for Psychological Science*, *3*(5), 400–424. https://doi.org/10.1111/j.1745-6924.2008.00088.x

Ottaviani, C., Thayer, J. F., Verkuil, B., Lonigro, A., Medea, B., Couyoumdjian, A., & Brosschot, J. F. (2016). Physiological concomitants of perseverative cognition: A systematic review and meta-analysis. *Psychological Bulletin*, *142*(3), 231–259. https://doi.org/10.1037/bul0000036

Peters, J. R., Geiger, P. J., Smart, L. M., & Baer, R. A. (2014). Shame and borderline personality features: The potential mediating role of anger and anger rumination. *Personality Disorders: Theory, Research, and Treatment*, *5*(1), 1–9. https://doi.org/10.1037/per0000022

Rachman, S., Grüter-Andrew, J., & Shafran, R. (2000). Post-event processing in social anxiety. *Behaviour Research and Therapy*, *38*(6), 611–617. https://doi.org/10.1016/s0005-7967(99)00089-3

Radloff, L. S. (1977). The CES-D Scale: A Self-Report Depression Scale for Research in the General Population. *Applied Psychological Measurement*, *1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Rajkumar, R. P. (2020). COVID-19 and mental health: A review of the existing literature. *Asian Journal of Psychiatry*, *52*, 102066. https://doi.org/10.1016/j.ajp.2020.102066

Rehman, U., Shahnawaz, M. G., Khan, N. H., Kharshiing, K. D., Khursheed, M., Gupta, K., Kashyap, D., & Uniyal, R. (2021). Depression, Anxiety and Stress Among Indians in Times of Covid-19 Lockdown. *Community Mental Health Journal*, *57*(1), 42–48. https://doi.org/10.1007/s10597-020-00664-x

Rossi, R., Socci, V., Talevi, D., Mensi, S., Niolu, C., Pacitti, F., Di Marco, A., Rossi, A., Siracusano, A., & Di Lorenzo, G. (2020). COVID-19 Pandemic and Lockdown Measures Impact on Mental Health Among the General Population in Italy. *Frontiers in Psychiatry*, *11*. https://doi.org/10.3389/fpsyt.2020.00790

Salari, N., Hosseinian-Far, A., Jalali, R., Vaisi-Raygani, A., Rasoulpoor, S., Mohammadi, M., Rasoulpoor, S., & Khaledi-Paveh, B. (2020). Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: A systematic review and meta-analysis. *Globalization and Health*, *16*(1), 1–11. https://doi.org/10.1186/s12992-020-00589-w

Sauer-Zavala, S., Gutner, C. A., Farchione, T. J., Boettcher, H. T., Bullis, J. R., & Barlow, D. H. (2017). Current Definitions of "Transdiagnostic" in Treatment Development: A Search for Consensus. *Behavior Therapy*, *48*(1), 128–138. https://doi.org/10.1016/j.beth.2016.09.004

Sauro, K. M., & Becker, W. J. (2009). The Stress and Migraine Interaction. *Headache: The Journal of Head and Face Pain*, *49*(9), 1378–1386. https://doi.org/10.1111/j.1526-4610.2009.01486.x

Selby, E. A., Anestis, M. D., & Joiner, T. E. (2008). Understanding the relationship between emotional and behavioral dysregulation: Emotional cascades. *Behaviour Research and Therapy*, *46*(5), 593–611. https://doi.org/10.1016/j.brat.2008.02.002

Selby, E. A., & Joiner, T. E. (2009). Cascades of Emotion: The Emergence of Borderline Personality Disorder from Emotional and Behavioral Dysregulation. *Review of General Psychology : Journal of Division 1, of the American Psychological Association*, *13*(3), 219. https://doi.org/10.1037/a0015687

Simon, A. (1998). A Zung-féle önértékelő depresszió skála. In F. Mérei & F. Szakács (Eds.), & M. Csabai, K. Görgényi, & I. Münnich (Trans.), *Pszichodiagnosztikai vademecum I/1.: Explorációs és biográfiai módszerek, tünetbecslő skálák, kérdőívek 1.* (1st ed., pp. 180–185). Nemzeti Tankönyvkiadó.

Smits, D. J. M., Vermote, R., Claes, L., & Vertommen, H. (2009). The Inventory of Personality Organization–Revised: Construction of an Abridged Version. *European Journal of Psychological Assessment*, *25*(4), 223–230. https://doi.org/10.1027/1015-5759.25.4.223

Song, X., & Wang, X. (2012). Mind Wandering in Chinese Daily Lives – An Experience Sampling Study. *PLoS ONE*, *7*(9), e44423. https://doi.org/10.1371/journal.pone.0044423

Stewart, W. F., Lipton, R. B., Kolodner, K. B., Sawyer, J., Lee, C., & Liberman, J. N. (2000). Validity of the Migraine Disability Assessment (MIDAS) score in comparison to a diary-based measure in a population sample of migraine sufferers. *Pain*, *88*(1), 41–52. https://doi.org/10.1016/s0304-3959(00)00305-5

Tabachnick, B., & Fidell, L. S. (2012). *Using Multivariate Statistics* (6th edition). Pearson Education Limited.

Tanner, A., Voon, D., Hasking, P., & Martin, G. (2013). Underlying structure of ruminative thinking: Factor analysis of the Ruminative Thought Style Questionnaire. *Cognitive Therapy and Research*, *37*(3), 633–646. https://doi.org/10.1007/s10608-012-9492-1

Treynor, W., Gonzalez, R., & Nolen-Hoeksema, S. (2003). Rumination Reconsidered: A Psychometric Analysis. *Cognitive Therapy and Research, 27*(3), 247–259. https://doi.org/10.1023/A:1023910315561

Urbán, R., Kun, B., Farkas, J., Paksi, B., Kökönyei, G., Unoka, Z., Felvinczi, K., Oláh, A., & Demetrovics, Z. (2014). Bifactor structural model of symptom checklists: SCL-90-R and Brief Symptom Inventory (BSI) in a non-clinical community sample. *Psychiatry Research, 216*(1), 146–154. https://doi.org/10.1016/j.psychres.2014.01.027

Vindegaard, N., & Benros, M. E. (2020). COVID-19 pandemic and mental health consequences: Systematic review of the current evidence. *Brain, Behavior, and Immunity, 89*, 531–542. https://doi.org/10.1016/j.bbi.2020.05.048

Wahl, K., Ertle, A., Bohne, A., Zurowski, B., & Kordon, A. (2011). Relations between a ruminative thinking style and obsessive–compulsive symptoms in non-clinical samples. *Anxiety, Stress, & Coping, 24*(2), 217–225. https://doi.org/10.1080/10615806.2010.482985

Watkins, E., Moulds, M., & Mackintosh, B. (2005). Comparisons between rumination and worry in a non-clinical population. *Behaviour Research and Therapy, 43*(12), 1577–1585. https://doi.org/10.1016/j.brat.2004.11.008

Watkins, E. R., & Roberts, H. (2020). Reflecting on rumination: Consequences, causes, mechanisms and treatment of rumination. *Behaviour Research and Therapy, 127*, 103573. https://doi.org/10.1016/j.brat.2020.103573

Williams, D. P., Feeling, N. R., Hill, L. K., Spangler, D. P., Koenig, J., & Thayer, J. F. (2017). Resting Heart Rate Variability, Facets of Rumination and Trait Anxiety: Implications for the Perseverative Cognition Hypothesis. *Frontiers in Human Neuroscience, 11*. https://doi.org/10.3389/fnhum.2017.00520

Xiong, J., Lipsitz, O., Nasri, F., Lui, L. M. W., Gill, H., Phan, L., Chen-Li, D., Iacobucci, M., Ho, R., Majeed, A., & McIntyre, R. S. (2020). Impact of COVID-19 pandemic on mental health in the general population: A systematic review. *Journal of Affective Disorders, 277*, 55–64. https://doi.org/10.1016/j.jad.2020.08.001

Ye, B., Wu, D., Im, H., Liu, M., Wang, X., & Yang, Q. (2020). Stressors of COVID-19 and stress consequences: The mediating role of rumination and the moderating role of psychological support. *Children and Youth Services Review, 118*, 105466. https://doi.org/10.1016/j.childyouth.2020.105466

Zung, W. W. (1965). A Self-Rating Depression Scale. *Archives of General Psychiatry, 12*, 63–70. https://doi.org/10.1001/archpsyc.1965.01720310065008

LIST OF PUBLICATIONS INCLUDED IN THE DISSERTATION

Kovács, L. N.*, Kocsel, N.*, Galambos, A., Magi, A., Demetrovics, Z., & Kökönyei, G. (2021). Validating the bifactor structure of the Ruminative Thought Style Questionnaire—A psychometric study. *PLOS ONE, 16*(7). https://doi.org/10.1371/journal.pone.0254986

Kovács, L. N., Takacs, Z. K., Tóth, Z., Simon, E., Schmelowszky, Á., & Kökönyei, G. (2020). Rumination in major depressive and bipolar disorder—A meta-analysis. *Journal of Affective Disorders, 276*, 1131–1141. https://doi.org/10.1016/j.jad.2020.07.131

Kovács, L. N., Schmelowszky, Á., Galambos, A., & Kökönyei, G. (2021). Rumination mediates the relationship between personality organization and symptoms of borderline personality disorder and depression. *Personality and Individual Differences, 168*, 110339. https://doi.org/10.1016/j.paid.2020.110339

Kovács, L. N., Baksa, D., Dobos, D., Eszlári, N., Gecse, K., Kocsel, N., Juhász, G., & Kökönyei, G. (2021). Perceived stress in the time of COVID-19: The association with brooding and COVID-related rumination in adults with and without migraine. *BMC Psychology, 9*(1), 68. https://doi.org/10.1186/s40359-021-00549-y

*These authors contributed equally to this work.

Note: Each co-author has granted permission for the given publication to be included in the dissertation.

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LIST OF PUBLICATIONS DIRECTLY NOT USED IN THE DISSERTATION

Kokonyei, G., **Kovacs, L. N.,** Baksa, D., Kocsel, N., Gecse, K., Dobos, D., Eszlari, N., & Juhasz, G. (2021). P. 0513 Midcingulate activation to inhibiting prepotent response in Emotion-Face Stroop Task is associated with Covid-related ruminative thoughts. *European Neuropsychopharmacology*, S378–S379.

Kovács, L. N., Baksa, D., Dobos, D., Eszlári, N., Gecse, K., Kocsel, N., Juhász, G., & Kökönyei, G. (2021). Perceived stress in the time of COVID-19: The association with brooding and COVID-related rumination in adults with and without migraine. Poster session, presented at the *Society for Research in Psychopathology, USA*, online conference.

Kovács, L. N., Schmelowszky, Á. (2018). Borderline Features, Alcohol Consumption and Rumination from a Dimensional Perspective. Poster session, presented at the *International Symposium on Current Issues and Controversies in Psychiatry: Complexity in Psychiatry*, Barcelona, Spain.

Kovács, L. N., Schmelowszky, Á. (2018). Exploring the Connections between Rumination, Borderline Symptoms and Personality Organization. In: Clarkin, John, Dazzi, Sergio, Delaney, Jill, Doering, Stephan, & Vegué, Joan (Eds.) *5th Conference of the International Society of Transference-Focused Psychotherapy: Scientific Program (pp. 6)*, Barcelona, Spain.

Kovács, L. N., Schmelowszky, Á., Galambos, A., & Kökönyei, Gy. (2019). A személyiség-szerveződés szintjének magyarázó ereje a ruminációra a borderline és a depresszív tünetek kontrollálása mellett. In: Lippai, Edit (Ed.) *Összetart a sokszínűség: A Magyar Pszichológiai Társaság XXVIII. Jubileumi Országos Tudományos Nagygyűlése: Kivonatkötet* [*Converging diversity*: *XXVIIIth Annual Meeting of the Hungarian Psychological Association: Abstract book*] (pp. 102-103), Debrecen, Hungary.

Kovács, L. N., Takács, Zs. K., Tóth, Zs., Simon, E., Kökönyei, Gy. (2020). Rumináció unipoláris és bipoláris depresszióban – metaanalízis. Poster session, presented at *Életutak a Pszichiátriában: a Magyar Pszichiátriai Társaság XXIII. Jubileumi Vándorgyűlése* [*Life paths in Psychiatry*: *XXIIIrd Annual Meeting of the Hungarian Psychiatric Association]*, Budapest, Hungary.