Mindfulness as Protective Factor Against Psychopathology Through the Use of Acceptance and Rumination: A General Population Study

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Abstract

Background. Subthreshold psychopathology, characterized by symptoms below the clinical threshold required for diagnosing a mental disorder, is associated with functional impairments and increased healthcare costs. Mindfulness has been identified as a protective factor against mental disorders and their subthreshold expressions, potentially through its influence on emotion regulation strategies such as acceptance and rumination. However, the relationship between mindfulness and psychopathology under consideration of acceptance and rumination as simultaneous working mechanisms was not yet investigated. ***Aim***. This study examines the mediating roles of acceptance and rumination in the relationship between mindfulness and psychopathology. ***Methods***. A cross-sectional secondary data analysis was conducted using self-report measures from 58 participants. Mindfulness was assessed with the Five Facet Mindfulness Questionnaire, acceptance and rumination with the Cognitive Emotion Regulation Questionnaire, and psychopathology with the Symptom Checklist-90-R. A parallel mediation model was tested using Structural Equation Modeling, with bootstrapping applied. ***Results***. Mindfulness was significantly negatively associated with psychopathology. However, neither acceptance nor rumination significantly mediated this relationship. Both acceptance and rumination showed a small, positive correlation with psychopathology. Model fit indices indicated acceptable model quality. ***Discussion***. The findings confirm mindfulness as a protective factor against psychopathology but do not support mediation via acceptance or rumination. Possible explanations include opposing indirect effects canceling each other out and limited statistical power. Future research should explore potential moderators, distinguish adaptive from maladaptive acceptance, and utilize longitudinal designs to clarify causal relationships.

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An estimated 38.2 percent of the European population suffers from a mental disorder each year, with anxiety, insomnia and major depression being the most prevalent disorders (Wittchen et al., 2011). Research has shown the devastating effects of this high prevalence on health care systems as well as on the wider economy. These effects are demonstrated by figures of productivity loss, absence, early retirement and high pharmaceutical expenditures (Doran & Kinchin, 2019). Next to that, the affected individual might experience functional impairments in a variety of life areas, which ultimately have an effect on the perceived quality of life (Castelpietra et al., 2022; Konnopka & König, 2020; Christensen et al., 2020; Rogers et al., 2014).

Additionally, there seems to be an even higher number of people affected by subthreshold psychopathology, which can be defined as the experience of symptoms, which are below the clinical cut-off of a specific disorder (Zhang et al., 2023). Although the experienced symptoms are not sufficient for a diagnosis, subthreshold mental disorders cause functional impairment and can be as persisting as their full-blown counterparts (Schreuder et al., 2021). Moreover, subthreshold psychopathology oftentimes resembles a nonspecific mixture of early symptoms, which can develop into more than one direction (van Os, 2013). Hence, its presence constitutes a vulnerability factor for developing a full-blown disorder, which does not even have to belong to the same diagnostic category as the initial symptoms, which underlines the need to intervene as early as possible. Beyond clinical implications, subthreshold psychopathology also poses a substantial economic burden. Subthreshold mental disorders, such as depression, generalized anxiety disorder, and panic disorder, contribute significantly to healthcare costs, with estimates suggesting they increase health care expenditures by around 30 percent in addition to the costs arising from their full-blown expressions (Zhang et al., 2023; Batelaan et al., 2007, Haller et al., 2014). These findings highlight the clinical and economic relevance of subthreshold psychopathology, emphasizing the need to investigate protective factors that support well-being and prevent transition into full-blown conditions.

Moreover, prior research shows that a large proportion of mental disorders develop during adolescence and early adulthood. A meta-analysis including 192 studies from more than 20 countries found that 62,5 percent of the participants experienced the onset of psychopathology by the age of 25 (Solmi et al., 2021). Given the benefits of intervening during sensitive periods regarding the development of psychopathology, which are in childhood, adolescence and early adulthood (Arango et al., 2018), it is crucial to establish protective factors for younger individuals, so that the development of psychopathology can be mitigated as early as possible.

Mindfulness may serve as a general protective factor for psychopathology, as it has been established as a protective factor for a variety of mental health issues, however with differing effect sizes (Karyadi et al., 2014; Carpenter et al., 2019). Mindfulness can be defined as self-regulation of attention on the immediate experience on the one hand, and adopting a stance of curiosity, openness, and acceptance on the other hand (Bishop et al., 2004). Furthermore, trait mindfulness can be cultivated via mindfulness practice (Kiken et al., 2015), which has been embedded in a variety of interventions, called mindfulness-based interventions (MBIs). These MBIs have proven effective in the clinical context for substance use disorders (Bowen et al., 2014), psychotic symptoms (Liu et al., 2021), depression and anxiety disorders (Barcaccia et al., 2022), and food addiction (Bunio et al., 2021). Therefore, mindfulness might act transdiagnostically as a protective factor against psychopathology.

Emotion regulation, defined as any goal-directed attempt to influence the subsequent experience of an emotion (Gross, 2015), is another important factor in many disorders. Studies on the relationship between emotion regulation and mindfulness show that higher levels of trait mindfulness relate to fewer emotion regulation difficulties (Hill & Updegraff, 2012), opening up the possibility to reduce dysfunctional emotion regulation, which is a maintenance process evident in a range of mental disorders (Chambers et al., 2009). A meta-analytic review investigating emotion regulation strategies in adolescents experiencing subthreshold psychopathology found that acceptance, rumination, and avoidance showed the strongest relationships with psychopathology, with acceptance being negatively correlated and both rumination and avoidance being positively related to psychopathology (Schäfer et al., 2017). Rumination encompasses as a passive, repetitive and evaluative thinking style focused on

causes, meanings and consequences (Joubert et al., 2022), while acceptance is defined as a favorable attitude toward an idea, situation or another object of attention (APA Dictionary of Psychology, n.d.). In the clinical context, similar emotion regulation strategies were found as working mechanisms of mindfulness, with decreases in rumination and increases in acceptance and reappraisal mediating the relationship between mindfulness and psychopathological symptoms (Pruessner et al., 2024). Hence, acceptance and rumination may both be transdiagnostic mechanisms, yet it remains unclear whether mindfulness exerts similar effects on these strategies in the general population.

A study conducted during the COVID-19 pandemic found a negative relationship between mindfulness and rumination, with higher levels of rumination associated with higher levels of depression, anxiety, and psychological distress in general (Mamede et al., 2022). Furthermore, an eight-week MBSR intervention led to a higher frequency in the use of adaptive emotion regulation strategies and a decrease in rumination on the long-term, providing evidence for the notion that trait mindfulness might have a long-lasting impact on rumination (Robins et al., 2012). Regarding the involvement of acceptance, higher levels of emotional acceptance were associated with less distress in relation to psychotic-like experiences in adults (Osborne et al., 2017), while for dissociation, mindfulness was negatively correlated to symptoms, also with emotional acceptance mediating this relationship (Vancappel et al., 2021). In younger individuals this relationship seems to hold, with higher dispositional mindfulness associated with fewer psychopathological symptoms, and self-acceptance mediating this relationship (Stein et al., 2022).

The above evidence suggests that mindfulness' protective properties against psychopathology may be explained by the transdiagnostic involvement of acceptance and rumination. Previous research supports the involvement of these two emotion regulation strategies as transdiagnostic factors associated with psychopathology (Schäfer et al., 2017, Pruessner et al., 2024). While acceptance and rumination are frequently studied separately, including both strategies in the same model might provide a more comprehensive understanding of the processes linking mindfulness and psychopathology in the general population. By constructing a model including both factors, the simultaneous contribution of both adaptive and maladaptive pathways can be captured, which aligns

with current models of emotion regulation (Aldao et al., 2010) Therefore, investigating both strategies simultaneously allows the assessment whether mindfulness operates by both strengthening adaptive and reducing maladaptive emotion regulation mechanisms. The transdiagnostic relevance of acceptance and rumination, alongside evidence of modulation through mindfulness, makes them prime candidates for understanding the protective mechanisms of mindfulness against psychopathology.

The current study explores the mediating roles of acceptance as an adaptive strategy and rumination as a maladaptive one in the relationship between mindfulness and psychopathology in the general population. In line with previous research, it is hypothesized that:

1. There is a significant negative correlation between levels of mindfulness and psychopathology.
2. Acceptance mediates the relationship between mindfulness and psychopathology, with higher mindfulness associated with greater acceptance and lower psychopathology.
3. Rumination mediates the relationship between mindfulness and psychopathology, with higher mindfulness associated with lower rumination and lower psychopathology.

Additionally, one exploratory analysis will compare the mediating effects of acceptance and rumination. It is hypothesized that acceptance will play a more important role, given its relevance for mindfulness and emotion regulation.

Method

Study Design and Procedure

The current study used data which was originally gathered by De Calheiros Velozo et al. (2022). In the original study, participants completed a laboratory stress task followed by a recovery period. Additionally, they underwent eight days of ecological momentary assessment, reporting stress and affect ten times daily via phone, which allowed for a comparison between laboratory and real-life stress responses. In the current study secondary analyses were conducted on the questionnaires which were administered during the pre-test phase of the original study. This study adopted a cross-sectional research design allowing the establishment of links between psychopathology and its psychological

determinants without any form of manipulation of such variables. The mediation model was computed using Structural Equation Modelling (SEM), which allows simultaneous analysis of multiple relationships while addressing measurement error (Matsueda, 2012). The current study was approved by the Sociaal-Maatschappelijke Etische Commissie (SMEC) of KU Leuven.

Participants

Participants were recruited utilizing convenience sampling in the form of flyers and online advertisements. Inclusion criteria were literacy of the Dutch language and age ranging between 18 and 35 years. Participants were excluded, if they had a history of cardiovascular or endocrine diseases, or chronically used medications or illicit drugs, next to working night shifts and having certain allergies (for further information please consult the original study). Lastly, participants were granted a reward of 30€ as compensation after completing the study.

Measures

Mindfulness. The variable mindfulness was measured using the Five Facet Mindfulness Questionnaire (FFMQ; Baer et al., 2006). It is a 39-item self-report questionnaire, which measures mindful strategies in daily life, with higher scores indicating greater display of mindfulness. Items (for example, “I perceive my thoughts and emotions without having to react to them”) are rated on a 5-point-Likert scale ranging from 1 (never or rarely true) to 5 (very often or always true). The total scale demonstrated good internal reliability, as measured by Chronbach’s alpha ($\alpha = 0.89$). For the purpose of this study, an overall average score was calculated from all items, with a range from 1 to 5, and higher scores representing higher levels of mindfulness. Information about the corresponding items can be found in the original paper written by Baer et al. (2006).

Acceptance and Rumination. Acceptance and rumination were measured deploying the Cognitive Emotion Regulation Questionnaire (CERQ, Garnefski et al., 2001). The CERQ is constructed by nine subscales, with each subscale representing one of the nine cognitive emotion regulation strategies. According to the response to a threatening life event, 39 items (e.g. “I often think about how I feel about what I have experienced”) are rated on a 5-point-Likert scale, ranging from 1 (almost never) to 5 (almost always). For the current study, only the acceptance and rumination subscales were

considered to ensure reliable estimates of the SEM (Kline, 2015, p.16). Both scales demonstrated good internal reliability, as measured by Cronbach's alpha ($\alpha = 0.81$ and $\alpha = 0.87$, respectively). Furthermore, mean scores were calculated from the items of the respective subscales with a possible range of 1 to 5, and with higher scores indicating greater display of the respective emotion regulation strategy.

Psychopathology. Psychopathology was measured with the Revised Symptom Checklist-90 (SCL-90-R; Derogatis, 1992). The SCL-90-R is a screening questionnaire, which measures subjective symptom burden of one individual. Furthermore, the SCL-90 is divided into nine categories, namely *somatization, obsessive compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism.* According to the extent each symptom has bothered the respondent during the last week, items (e.g., "feeling lonely" or "worrying too much about things") are rated on a 5-point-Likert scale, with 0 indicating none at all and 4 indicating extremely. Internal consistency of the SCL-90-R was assessed using Cronbach's alpha. The SCL-90-R demonstrated excellent reliability with a Cronbach's alpha of 0.96. For the current study, the General Severity Index (GSI) was calculated to indicate the overall level of distress. The GSI measures general psychological stress and is calculated by summing the scores of all observations and dividing them by the number of observations, resulting in a scale ranging from 0 to 4, where higher scores indicate higher distress (Franke, 2000).

Data Analysis

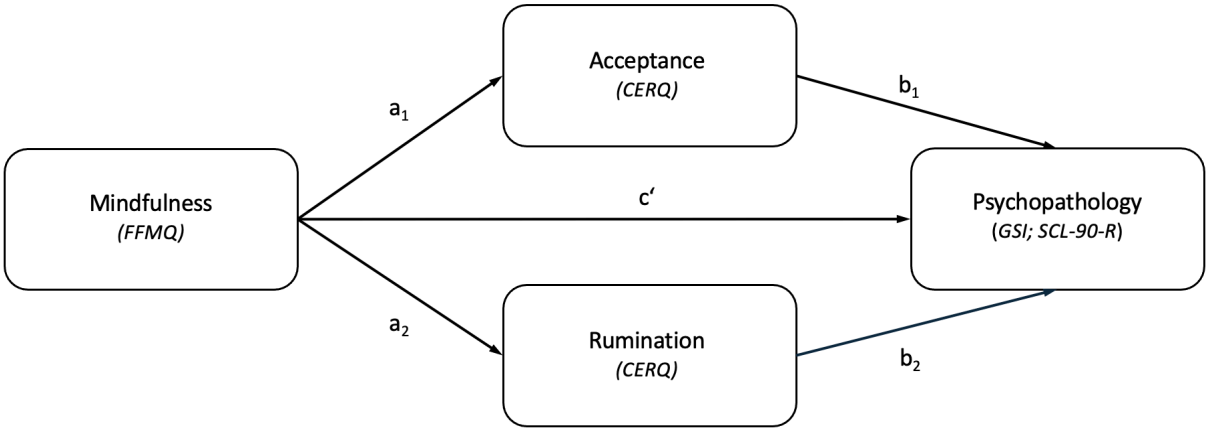
To perform the mediation analysis, the R-package 'lavaan' (Rosseel, 2012) was utilized. The lavaan package offers the possibility to perform a multiple mediation as a structural equation model. A multiple mediation differs from a single mediation model in that it includes at least one additional mediator, which can be included sequentially or in parallel.

After clearing the data set from irrelevant data, recoding reversed items in excel and deletion of incomplete data, the data set was transferred into R. To conduct the parallel mediation with two parallel mediators, a structural equation model (SEM) was created with the mean score of *mindfulness* as independent variable, *acceptance* and *rumination* as mediators, and *GSI* as dependent variable (see Figure 1). To reduce the complexity of the model given the small sample size, latent variable constructions in which multiple related items are combined into one underlying factor were omitted,

and instead mean scores were calculated for all measurements. This approach aimed at optimizing statistical power and preventing potential overfitting (Kline, 2015, p.16, 459).

Figure 1

Mediation model showing the proposed relationships between mindfulness, acceptance, rumination, and psychopathology (GSI)



Assumptions of a parallel mediation were checked by utilizing the studentized Breusch-Pagan test to assess homoscedasticity, and the Shapiro-Wilk test to assess the assumption of normality. A significant studentized Breusch-Pagan test (Leamer, 2010), respectively Shapiro-Wilk test (Field, 2018), p.332) indicates a violation of the respective assumption. The assumption of linearity was visually assessed and the assumption of absence of multicollinearity was checked calculating the Variance Inflation Factor (VIF), with values below five considered to indicate absence of multicollinearity (Field, 2018, p. 509; Montgomery et al., 2012). A correlation matrix of the variables was computed in order to get a first understanding of the relationships between the variables and to ensure the main analysis is justified.

Subsequently, the main analysis was conducted by utilizing SEM to perform the parallel mediation (the exact model can be found in Appendix 1, Rcode). For the evaluation of model fit, the Comparative Fit Index (with values ranging from 0 to 1, and values closer to 1 indicating good fit), as well as the Standardized Root Mean Residual (with values between 0.08 and 0.10 deemed acceptable, and values higher than 0.10 indicating poor fit) were calculated (Hooper et al., 2008). To investigate the exploratory hypothesis, the difference between the two indirect effects was computed and tested

against zero. The significance of this difference was assessed using bias-corrected bootstrap confidence intervals, as recommended by Preacher & Hayes (2008).

Results

Descriptives

The final sample of this study consisted of 58 participants, with a mean age of 24, and 86 percent being of Belgian nationality (for demographics consult Table 1). Descriptive statistics and correlations for all variables are presented in Table 2. Mindfulness had a small, significant negative correlation with age and a strong, significant negative correlation with GSI. Acceptance and rumination were significantly positively correlated with each other, with a small effect size.

Table 1
Demographics (N= 58)

Variable		Mean (SD)	Frequency	Min.	Max.
Gender		0.84 (0.37)	58	0	1
	Male		9		
	Female		49		
Age		24.16 (3.29)	58	19	35
Nationality			58		
	Belgian		50		
	Dutch		4		
	Other		4		
Mindfulness		3.34 (0.51)	58	1.79	4.26
Acceptance		3.48 (0.90)	58	1.25	5
Rumination		3.33 (1.06)	58	1	5
GSI		0.63 (0.43)	58	0.1	1.96

Mediation Analysis

Although inter-variable correlations were moderately high in some instances (see Table 2), VIF values all were below five (see Table 3), indicating no issues with multicollinearity. The Studentized Breusch-Pagan test did show evidence of heteroscedasticity ($\chi^2(3) = 11.65$, $p < .05$). The assumption of linearity was violated (see Appendix 2, Figure 1), and the Shapiro-Wilk test for normality was significant (Shapiro-Wilk $W = 0.91$, $p < .001$). A quadratic term was tested to examine potential non-linear effects (Grambsch & O'Brian, 1991). As it did not provide additional explanatory value, the primary analysis was conducted using the linear model. Since the assumptions of normality and homoscedasticity were also violated, the Bootstrapping method was used for the main analysis (Bootstrapping sample = 1000; Shrout & Bolger, 2002). The SEM model demonstrated acceptable fit, as shown by the Comparative Fit Index (CFI = .94) and the Standardized Root Mean Residual (SRMR = .084).

Table 2
Mean, standard deviation and correlations for gender, age, mindfulness, acceptance, rumination and GSI

Variable	M	SD	1	2	3	4	5	6
1. Gender	0.84	0.37	-					
2. Age	24.16	3.29	0.03	-				
3. Mindfulness	3.34	0.51	-0.01	-0.29*	-			
4. Acceptance	3.48	0.90	0.00	0.09	-0.03	-		
5. Rumination	3.33	1.06	0.17	0.18	-0.10	0.26*	-	
6. GSI	0.63	0.43	0.14	0.19	-0.74**	0.22	0.25	-

Note. * indicates $p < 0.05$, ** indicates $p < 0.001$

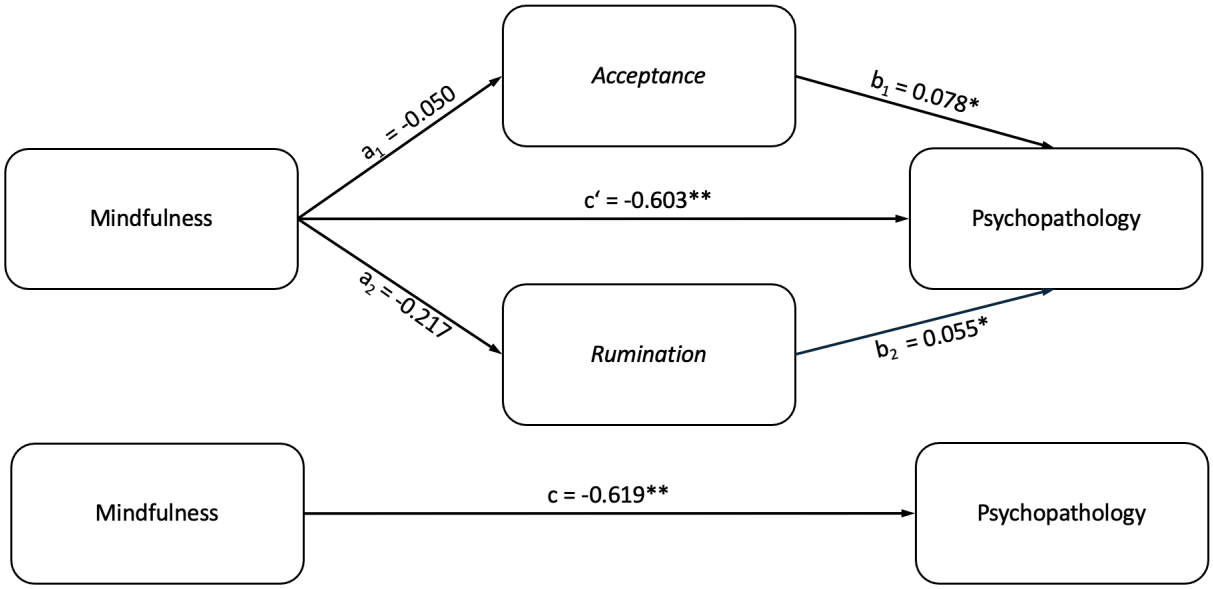
Table 3
VIF values for independent variable and mediators

Variable	VIF value
Mindfulness	1.011
Acceptance	1.074
Rumination	1.086

To test the first hypothesis stating *there is a significant negative correlation between levels of mindfulness and levels of psychopathology*, the total effect of the SEM was utilized, taking the effect of acceptance and rumination into account. Thus, path c was considered (see Figure 2). Path c from *mindfulness* to *GSI* was significant (β = -0.619, *SE* = 0.120, $p < .001$). Path c', representing the direct effect of *mindfulness* on *GSI* was also significant (β = -0.603, *SE* = 0.117, $p < .001$). Hence, in line with the first hypothesis, the total effect of mindfulness on psychopathology was significant and negative while controlling for the mediators. Furthermore, the direct effect of mindfulness on psychopathology was also significant and negative, demonstrating a strong relationship between these variables also without the consideration of the included mediators.

To test the competing second and third hypotheses, the indirect effects of *mindfulness* through *acceptance*, respectively *rumination,* on *GSI* were considered. The indirect effect of *mindfulness* on *GSI* through *acceptance* (a_1b_1) was insignificant (β = -0.004, *SE* = 0.023, 95% Bca CI [-0.046, 0.051]). Hence, contrary to the second hypothesis, the indirect effect of mindfulness on psychopathology through acceptance was insignificant.

Figure 2
Standardized estimates of the mediation model



Note. * means $p < .05$, ** means $p < .001$. c' denotes the direct effect, c denotes the total effect. Indirect effects were negligible and non-significant.

The indirect effect of *mindfulness* on *GSI* through *rumination* (a_2b_2) was also insignificant (β = -0.012, *SE* = 0.018, 95% Bca CI [-0.056, 0.018]). Thus, the indirect effect of mindfulness on psychopathology through rumination was also insignificant and hypothesis three must be refuted. To account for the possibility that the two indirect effects cancel each other out, two single mediation analyses were conducted separately for each mediator. In both analyses neither pathway showed a significant indirect effect. Hence, in the current sample neither acceptance, nor rumination significantly accounted for the relationship between mindfulness and GSI. Therefore, the mediating effects cannot be compared, and the exploratory hypothesis must be refuted.

Discussion

Main Findings

The present study investigated the role of mindfulness as protective factor against psychopathology through the emotion regulation strategies acceptance and rumination. The parallel mediation showed significant direct and total effects of mindfulness on psychopathology, with higher levels of mindfulness associated with lower levels of psychopathology. Secondly, the results demonstrated non-significant indirect effects via both mediators, indicating that the relationship between mindfulness and psychopathology was not explained by acceptance nor rumination in the present sample. Thirdly, both acceptance and rumination showed a small, but significant positive association with psychopathology.

Why Acceptance and Rumination Did Not Mediate the Effect of Mindfulness

In the current study, mindfulness was negatively related to psychopathology, as the model showed a moderate direct effect of mindfulness on psychopathology, as well as a moderate total effect. The negative relationship between mindfulness and psychopathology was already demonstrated by prior research conducted in the general population (Pepping et al., 2016). However, the current model showed no significant mediation by acceptance or rumination. This finding conflicts with previous research providing evidence for acceptance and rumination as mediators in the relationship between mindfulness and psychopathology, albeit the mediators acting in separate models (Mamede et al., 2022; Pruessner et al., 2024; Stein et al., 2022). As neither of both hypothesized pathways was found

in this study, it is possible that including both mediators in one model might have influenced how mindfulness and emotion regulation act regarding psychopathology.

Consequently, one explanation for the insignificant mediation might be of statistical nature. It is possible that the indirect effects of acceptance, respectively rumination were obscured by the opposite directions of the emerged indirect effects (MacKinnon, 2008, p.68). If mindfulness is associated with reduced rumination, which in turn lowers psychopathology, but at the same time is associated with higher acceptance, which unexpectedly relates to higher psychopathology in this sample, these two indirect paths may point in opposite directions. This could explain the absence of a significant total indirect effect. To test whether the indirect effects cancel each other out, additional mediation analyses were conducted separately for each mediator. However, these separate analyses did not yield any new insights, as neither pathway showed a significant indirect effect, which supports the interpretation that in the present sample, the expected indirect effects do not even emerge. Thus, it might be that sample-specific aspects (like personality traits or severity of psychopathology) might have a moderating effect on the hypothesized relationships. Future studies should address this finding by including factors, which might have a moderating influence on the interplay of mindfulness, acceptance, rumination and psychopathology.

Furthermore, it is also possible that the absence of a significant indirect effect reflects a statistical error due to limited statistical power, as small indirect effects require large sample sizes to be reliably detected (Fritz & MacKinnon, 2007). With a sample size of only 58 participants, failing to detect an indirect effect cannot be ruled out. Future research should aim to replicate these findings with a substantially bigger sample leading to more statistical power, which consequently should minimize the likelihood of a type II error.

Addressing the Positive Relationship Between Acceptance and Psychopathology

Another important finding of this study is that both acceptance and rumination emerged as significant, albeit small, positive predictors of psychopathology. In the case of rumination this relationship was expected: For instance, a study investigating mindfulness, rumination and psychopathology also found evidence for the positive relationship between rumination and

psychopathology (Mamede et al., 2022). For acceptance, however, it was hypothesized that acceptance would have a negative relationship with psychopathology (Kotsou et al., 2018).

It is likely that the positive association between acceptance and psychopathology is a result of low statistical power, which in the case of acceptance might have resulted in a type I error. According to Fritz & MacKinnon (2007), detecting small effect sizes of only 0.14 requires more than 400 participants. Hence, the current sample size might have been too small to reliably detect small relationships. Future research might address this concern by trying to replicate the findings in a larger sample.

The positive relationship of acceptance and psychopathology might also be explained by the potential two-sidedness of acceptance. Contrary to active acceptance, resigning acceptance is a form of acceptance, where feelings of hopelessness, avoidance or disappointment are dominant. Notably, resigning acceptance correlates negatively with mental health outcomes (Nakamura & Orth, 2005), which might explain the directionality of acceptance found in this study. It is possible, that individuals in the current sample might not have relied on active acceptance (having a positive relationship with mental health outcomes), but on resigning acceptance. This notion is further supported by acceptance resulting in the lowest test-retest correlation compared to other emotion regulation strategies of the CERQ (Garnefski et al., 2001). Future studies should consider the possible influence of resigning acceptance and hence include acceptance as adaptive as well as maladaptive form in their models.

Limitations

One major limitation of this study is its cross-sectional research design. Performing a mediation on cross-sectional data might give insights into existing relationships; however, it is impossible to draw causal conclusions from this data or gain insights into temporal precedence without deploying longitudinal or experimental study designs. Future studies should address this question by conducting experimental research, in which levels of mindfulness are manipulated in-between measurement points of psychopathology. Additionally, an experimental research design would allow manipulation of the variables mindfulness, acceptance, and rumination, thereby increasing internal validity by providing greater control over potential confounds. Notably, the current sample was not manipulated

regarding their levels of mindfulness, thus this study is contributing to the body of naturalistic research, which is a valuable addition to the existing body of research due to its high external validity (Dasgupta & Stout, 2012).

Another limitation of this study is the structure of the sample. First, the generalizability of the current findings is limited by the sample demographics, with 84 percent of the included participants being female, and the oldest participant being 35. This prevents inferences about older populations, in which mindfulness and emotion regulation might function differently (Prakash et al., 2015). Therefore, future research should aim to replicate these findings in broader age ranges and in a more diverse sample. In addition to that, the sample size (N=58) is relatively small, which reduces statistical power and increases the likelihood of statistical errors. Consequently, the reliability of the results is also limited. Lastly, as the sample size was taken into account when constructing the SEM, the model had to be reduced to essential aspects of the investigated relationships in favor of statistical power. A more nuanced model including all subscales of the included questionnaires might yield more insights into the relationships between specific mindfulness facets, acceptance, rumination and subscales of the SCL-90-R. Future studies should take a larger and more diverse sample, which would benefit generalizability and might warrant reliable results even when computing latent variables.

Conclusion

Taking everything into account, this study provides confirmatory evidence for the negative association between trait mindfulness and psychopathology. Considering that numerous studies provide evidence for the notion that mindfulness can enhance wellbeing in healthy populations as well (Querstret et al., 2020), mindfulness might serve as a transdiagnostic protective factor against psychopathology in the general population, thereby reducing healthcare costs and increasing the quality of life of a myriad of individuals.

Lastly, besides its effectiveness, mindfulness comes forth as cost-efficient intervention, as shown in a systematic review evaluating the cost-effectiveness of MBIs (Zhang et al., 2022). Findings

indicate that MBIs such as mindfulness-based cognitive therapy[1] not only alleviate symptoms but also reduce healthcare costs for people with a history of major depressive episodes, and people affected by anxiety, stress or adjustment disorder. Therefore, despite the non-significant mediation found in this study, mindfulness and its role for emotion regulation should still be further researched as cost-effective protective factor against psychopathology.

[1] Mindfulness-based cognitive therapy (MBCT) combines aspects of cognitive therapy with practices drawn from mindfulness (*Landing Page - MBCT.com*, 2021).

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Appendix 1

R-Code

```
# Load packages
library(psych)
library(lavaan)
library(ggplot2)
library(readxl)
library(semPlot)
library(dplyr)
library(car)
library(lmtest)
# Import the dataset
data <- read_excel("/Users/juliusgiszas/Documents/Msc/1UT/Master
Thesis/Writing/analysis/workingOLD.xlsx")
#_____________________________________________DESCRIPTIVES_____________
_____________________________________________________
#Calculate the mean of the 'demo_age' column & sex
mean_age <- mean(data$demo_age, na.rm = TRUE)  # na.rm = TRUE removes any
NA values from the calculation
mean_sex <- mean(data$demo_sex, na.rm = TRUE)
# Print the mean age & others
print(mean_age)
print(mean_sex)

# Standard deviations for each numeric column
sapply(data, function(x) if(is.numeric(x)) sd(x, na.rm = TRUE) else NA)

gender_counts <- count(data, demo_sex)
print(gender_counts)

nat_counts <- count(data, demo_nationality)
print(nat_counts)

#_____________________________________computing additional variables
(meanscores)_____________________________________________________________
___________
#defining ffmq_observe & other & subsequently calc mean
# Create a data frame for ffmq_observe
ffmq_observe <- data.frame(
  ffmq_body = data$ffmq_body,
  ffmq_water = data$ffmq_water,
  ffmq_food = data$ffmq_food,
  ffmq_bodily_experience = data$ffmq_bodily_experience,
  ffmq_sounds = data$ffmq_sounds,
  ffmq_smell = data$ffmq_smell,
  ffmq_vision = data$ffmq_vision,
  ffmq_emotions_influence = data$ffmq_emotions_influence)
# Add the mean column
ffmq_observe$mean_obs <- (ffmq_observe$ffmq_body + ffmq_observe$ffmq_water
+ ffmq_observe$ffmq_food + ffmq_observe$ffmq_bodily_experience +
```

```
ffmq_observe$ffmq_sounds + ffmq_observe$ffmq_smell +
ffmq_observe$ffmq_vision + ffmq_observe$ffmq_emotions_influence)/8
#_____________________________________
ffmq_nonjudge <- data.frame(
  ffmq_selfcriticism = data$ffmq_selfcriticism,
  ffmq_shouldntfeel = data$ffmq_shouldntfeel,
  ffmq_abnormal_thoughts = data$ffmq_abnormal_thoughts,
  ffmq_judgethoughts = data$ffmq_judgethoughts,
  ffmq_change_thoughts = data$ffmq_change_thoughts,
  ffmq_indecent_emotions = data$ffmq_indecent_emotions,
  ffmq_thoughts_judge = data$ffmq_thoughts_judge,
  ffmq_disapprove = data$ffmq_disapprove
)
ffmq_nonjudge$mean_non <- (ffmq_nonjudge$ffmq_selfcriticism +
ffmq_nonjudge$ffmq_shouldntfeel + ffmq_nonjudge$ffmq_abnormal_thoughts +
ffmq_nonjudge$ffmq_judgethoughts + ffmq_nonjudge$ffmq_change_thoughts +
ffmq_nonjudge$ffmq_indecent_emotions + ffmq_nonjudge$ffmq_thoughts_judge +
ffmq_nonjudge$ffmq_disapprove)/8

#_____________describe_______________________________
ffmq_describe <- data.frame(
  ffmq_words_emotions = data$ffmq_words_emotions,
  ffmq_words_expectations = data$ffmq_words_expectations,
  ffmq_words_thoughts = data$ffmq_words_thoughts,
  ffmq_words_think = data$ffmq_words_think,
  ffmq_words_body = data$ffmq_words_body,
  ffmq_upset = data$ffmq_upset,
  ffmq_words_capture = data$ffmq_words_capture,
  ffmq_describe_feel = data$ffmq_describe_feel
)
ffmq_describe$mean_des <- (ffmq_describe$ffmq_words_emotions +
ffmq_describe$ffmq_words_expectations + ffmq_describe$ffmq_words_thoughts +
ffmq_describe$ffmq_words_think + ffmq_describe$ffmq_words_body +
ffmq_describe$ffmq_upset + ffmq_describe$ffmq_words_capture +
ffmq_describe$ffmq_describe_feel)/8
#_____________nonreact_______________________________
ffmq_nonreact <- data.frame(
  ffmq_perceive = data$ffmq_perceive,
  ffmq_observe_feelings = data$ffmq_observe_feelings,
  ffmq_thoughts_carryaway = data$ffmq_thoughts_carryaway,
  ffmq_restrain = data$ffmq_restrain,
  ffmq_thoughts_calm = data$ffmq_thoughts_calm,
  ffmq_thoughts_noaction = data$ffmq_thoughts_noaction,
  ffmq_thoughts_letgo = data$ffmq_thoughts_letgo
)
ffmq_nonreact$mean_nonr <- (ffmq_nonreact$ffmq_perceive +
ffmq_nonreact$ffmq_observe_feelings + ffmq_nonreact$ffmq_thoughts_carryaway
+ ffmq_nonreact$ffmq_restrain + ffmq_nonreact$ffmq_thoughts_calm +
ffmq_nonreact$ffmq_thoughts_noaction + ffmq_nonreact$ffmq_thoughts_letgo)/7
#_____________actingwithawareness_____________________________
ffmq_awa <- data.frame(
  ffmq_distracted = data$ffmq_distracted,
  ffmq_daydream = data$ffmq_daydream,
```

```
  ffmq_distracted = data$ffmq_distracted,
  ffmq_attention_present = data$ffmq_attention_present,
  ffmq_pilot = data$ffmq_pilot,
  ffmq_hurry = data$ffmq_hurry,
  ffmq_work = data$ffmq_work,
  ffmq_unattending = data$ffmq_unattending
)
ffmq_awa$mean_awa <- (ffmq_awa$ffmq_distracted + ffmq_awa$ffmq_daydream +
ffmq_awa$ffmq_distracted + ffmq_awa$ffmq_attention_present +
ffmq_awa$ffmq_pilot + ffmq_awa$ffmq_hurry + ffmq_awa$ffmq_work +
ffmq_awa$ffmq_unattending)/8
#_____________total average ffmq &
ffmq_data.frame_____________________________
ffmq_total_mean <- rowMeans(data.frame(
  mean_awa = ffmq_awa$mean_awa,
  mean_obs = ffmq_observe$mean_obs,
  mean_des = ffmq_describe$mean_des,
  mean_nonr = ffmq_nonreact$mean_nonr,
  mean_non = ffmq_nonjudge$mean_non
), na.rm = TRUE)

ffmq_frame <- data.frame(
  ffmq_body = data$ffmq_body,
  ffmq_water = data$ffmq_water,
  ffmq_food = data$ffmq_food,
  ffmq_bodily_experience = data$ffmq_bodily_experience,
  ffmq_sounds = data$ffmq_sounds,
  ffmq_smell = data$ffmq_smell,
  ffmq_vision = data$ffmq_vision,
  ffmq_emotions_influence = data$ffmq_emotions_influence,

  ffmq_selfcriticism = data$ffmq_selfcriticism,
  ffmq_shouldntfeel = data$ffmq_shouldntfeel,
  ffmq_abnormal_thoughts = data$ffmq_abnormal_thoughts,
  ffmq_judgethoughts = data$ffmq_judgethoughts,
  ffmq_change_thoughts = data$ffmq_change_thoughts,
  ffmq_indecent_emotions = data$ffmq_indecent_emotions,
  ffmq_thoughts_judge = data$ffmq_thoughts_judge,
  ffmq_disapprove = data$ffmq_disapprove,

  ffmq_words_emotions = data$ffmq_words_emotions,
  ffmq_words_expectations = data$ffmq_words_expectations,
  ffmq_words_thoughts = data$ffmq_words_thoughts,
  ffmq_words_think = data$ffmq_words_think,
  ffmq_words_body = data$ffmq_words_body,
  ffmq_upset = data$ffmq_upset,
  ffmq_words_capture = data$ffmq_words_capture,
  ffmq_describe_feel = data$ffmq_describe_feel,

  ffmq_perceive = data$ffmq_perceive,
  ffmq_observe_feelings = data$ffmq_observe_feelings,
  ffmq_thoughts_carryaway = data$ffmq_thoughts_carryaway,
  ffmq_restrain = data$ffmq_restrain,
```

```
  ffmq_thoughts_calm = data$ffmq_thoughts_calm,
  ffmq_thoughts_noaction = data$ffmq_thoughts_noaction,
  ffmq_thoughts_letgo = data$ffmq_thoughts_letgo,

  ffmq_distracted = data$ffmq_distracted,
  ffmq_daydream = data$ffmq_daydream,
  ffmq_attention_present = data$ffmq_attention_present,
  ffmq_pilot = data$ffmq_pilot,
  ffmq_hurry = data$ffmq_hurry,
  ffmq_work = data$ffmq_work,
  ffmq_unattending = data$ffmq_unattending
)
# Create data_frame for the SCL-90-R items
SCL_total <- data.frame(
  scl_headache = data$scl_headache,
  scl_nervous = data$scl_nervous,
  scl_unpleasant_thoughts = data$scl_unpleasant_thoughts,
  scl_dizziness = data$scl_dizziness,
  scl_sexual = data$scl_sexual,
  scl_critical = data$scl_critical,
  scl_controlthoughts = data$scl_controlthoughts,
  scl_others_guilty = data$scl_others_guilty,
  scl_memorize = data$scl_memorize,
  scl_sloppiness = data$scl_sloppiness,
  scl_irritated = data$scl_irritated,
  scl_chestpain = data$scl_chestpain,
  scl_agoraphobia = data$scl_agoraphobia,
  scl_lackenergy = data$scl_lackenergy,
  scl_suicidalthoughts = data$scl_suicidalthoughts,
  scl_voices = data$scl_voices,
  scl_tremble = data$scl_tremble,
  scl_distrust = data$scl_distrust,
  scl_lackappetite = data$scl_lackappetite,
  scl_cry = data$scl_cry,
  scl_shy = data$scl_shy,
  scl_trapped = data$scl_trapped,
  scl_scared = data$scl_scared,
  scl_anger = data$scl_anger,
  scl_afraidleavehouse = data$scl_afraidleavehouse,
  scl_blame = data$scl_blame,
  scl_backpain = data$scl_backpain,
  scl_obstructed = data$scl_obstructed,
  scl_lonely = data$scl_lonely,
  scl_down = data$scl_down,
  scl_worry = data$scl_worry,
  scl_nointerest = data$scl_nointerest,
  scl_feelafraid = data$scl_feelafraid,
  scl_hurt = data$scl_hurt,
  scl_secrets = data$scl_secrets,
  scl_misunderstood = data$scl_misunderstood,
  scl_unkind = data$scl_unkind,
  scl_slow = data$scl_slow,
  scl_palpitations = data$scl_palpitations,
```

```
  scl_nausea = data$scl_nausea,
  scl_inferiority = data$scl_inferiority,
  scl_musclepain = data$scl_musclepain,
  scl_watched = data$scl_watched,
  scl_fallasleep = data$scl_fallasleep,
  scl_control = data$scl_control,
  scl_harddecision = data$scl_harddecision,
  scl_publictransport = data$scl_publictransport,
  scl_breathe = data$scl_breathe,
  scl_temperature = data$scl_temperature,
  scl_avoid = data$scl_avoid,
  scl_emptiness = data$scl_emptiness,
  scl_numb = data$scl_numb,
  scl_lumpthroat = data$scl_lumpthroat,
  scl_desperate = data$scl_desperate,
  scl_concentrate = data$scl_concentrate,
  scl_weak = data$scl_weak,
  scl_tense = data$scl_tense,
  scl_heavylimbs = data$scl_heavylimbs,
  scl_death = data$scl_death,
  scl_overeat = data$scl_overeat,
  scl_unease = data$scl_unease,
  scl_thoughtsothers = data$scl_thoughtsothers,
  scl_hurt_others = data$scl_hurt_others,
  scl_wakeearly = data$scl_wakeearly,
  scl_repeat = data$scl_repeat,
  scl_disturbedsleep = data$scl_disturbedsleep,
  scl_destroy = data$scl_destroy,
  scl_ideosyncraticthoughts = data$scl_ideosyncraticthoughts,
  scl_presence = data$scl_presence,
  scl_crowd = data$scl_crowd,
  scl_effort = data$scl_effort,
  scl_panicattacks = data$scl_panicattacks,
  scl_foodpublic = data$scl_foodpublic,
  scl_quarrel = data$scl_quarrel,
  scl_nervousalone = data$scl_nervousalone,
  scl_underestimate = data$scl_underestimate,
  scl_lonelycompany = data$scl_lonelycompany,
  scl_sitstill = data$scl_sitstill,
  scl_worthless = data$scl_worthless,
  scl_bad = data$scl_bad,
  scl_shout = data$scl_shout,
  scl_faint = data$scl_faint,
  scl_abuse = data$scl_abuse,
  scl_sexual_thoughts = data$scl_sexual_thoughts,
  scl_sins = data$scl_sins,
  scl_anxiousthoughts = data$scl_anxiousthoughts,
  scl_bodywrong = data$scl_bodywrong,
  scl_unconnected = data$scl_unconnected,
  scl_guilt = data$scl_guilt,
  scl_psychic = data$scl_psychic
)
# Calculate GSI for each respondent
```

```
SCL_total$GSI <- rowMeans(SCL_total, na.rm = TRUE)

GSI <- SCL_total$GSI
#optional GSI <- data.frame(GSI)

# Print the resulting data frame
print(SCL_total)
#_________________same for CERQ_____________________________
cerq_acceptance <- data.frame(
  cerq_accept_happened = data$cerq_accept_happened,
  cerq_learn_live = data$cerq_learn_live,
  cerq_nochange = data$cerq_nochange,
  cerq_accept = data$cerq_accept
)
cerq_acceptance$mean_acc <- (data$cerq_accept_happened +
data$cerq_learn_live + data$cerq_nochange + data$cerq_accept)/4
print(cerq_acceptance)

cerq_rumination <- data.frame (
  cerq_feel = data$cerq_feel,
  cerq_preoccupied = data$cerq_preoccupied,
  cerq_understand = data$cerq_understand,
  cerq_feelings = data$cerq_feelings
)
cerq_rumination$mean_rum <- (data$cerq_feel + data$cerq_preoccupied +
data$cerq_understand + data$cerq_feelings)/4
print (cerq_rumination)

#_____________________________________________corMatrix&chronbachsalpha_
_____________________________________________________________________________
_____
#CORRELATION MATRIX
data_cor <- data.frame(
  sex = data$demo_sex,
  age = data$demo_age,
  X = ffmq_total_mean,
  M1 = cerq_acceptance$mean_acc,
  M2 = cerq_rumination$mean_rum,
  Y = GSI )
result <- corr.test(data_cor)
print(result$r)
print(result$p)
print(result$ci)
#mean for variables
summary(data_cor)
#SDs
sapply(data_cor, function(x) if(is.numeric(x)) sd(x, na.rm = TRUE) else NA)

alpha_ffmq_frame <- psych::alpha(ffmq_frame)
alpha_ffmq_des <- psych::alpha(ffmq_describe[, !colnames(ffmq_describe)
%in% "mean_des"], check.keys = FALSE)
alpha_ffmq_obs <- psych::alpha(ffmq_observe[, !colnames(ffmq_observe) %in%
"mean_obs"], check.keys = FALSE)
```

```
alpha_ffmq_non <- psych::alpha(ffmq_nonjudge[, !colnames(ffmq_nonjudge)
%in% "mean_non"], check.keys = FALSE)
alpha_ffmq_nonr <- psych::alpha(ffmq_nonreact[, !colnames(ffmq_nonreact)
%in% "mean_nonr"], check.keys = FALSE)
alpha_ffmq_awa <- psych::alpha(ffmq_awa[, !colnames(ffmq_awa) %in%
"mean_awa"], check.keys = FALSE)
alpha_cerq_acceptance <- psych::alpha(cerq_acceptance[,
!colnames(cerq_acceptance) %in% "mean_acc"], check.keys = FALSE)
alpha_cerq_rumination <- psych::alpha(cerq_rumination[,
!colnames(cerq_rumination) %in% "mean_rum"], check.keys = FALSE)
alpha_SCL_total <- psych::alpha(SCL_total[, !colnames(SCL_total) %in%
"GSI"], check.keys = FALSE)
print(alpha_ffmq_frame)
print (alpha_ffmq_des)
print(alpha_ffmq_obs)
print(alpha_ffmq_non)
print(alpha_ffmq_nonr)
print(alpha_ffmq_awa)
print(alpha_cerq_acceptance)
print(alpha_cerq_rumination)
print(alpha_SCL_total)
#_____________________________________MAIN
ANALYSIS_____________________________________________________________
# Specify the SEM model for parallel mediation

data_combined <- data.frame(
  X = ffmq_total_mean,
  M1 = cerq_acceptance$mean_acc,
  M2 = cerq_rumination$mean_rum,
  Y = GSI)
#verify that combined dataframe is correct
str(data_combined)


sem_model <- '
  # Direct effect of X on Y
  Y ~ c*X

  # Mediator 1 affected by X
  M1 ~ a1*X
  Y ~ b1*M1

  # Mediator 2 affected by X
  M2 ~ a2*X
  Y ~ b2*M2

  # Indirect effects
  indirect_M1 := a1 * b1
  indirect_M2 := a2 * b2

  # Total effect
  total1 := c + (a1 * b1) + (a2 * b2)
'
```

```
# Fit the SEM model
fit <- sem(sem_model, data = data_combined, se="boot",  bootstrap=1000)

# Summarize the results
summary(fit, standardized = TRUE, fit.measures = TRUE, rsquare=T)
parameterEstimates(fit)


#_____________________________________ASSUMPTIONS (calc. AFTER
analysis!)_____________________________________________________
#1.Linearity
panel.lm <- function(x, y) {
  points(x, y)               # Plot the points
  abline(lm(y ~ x), col="red") # Add a linear trend line
}

pairs(data_combined[, c("X", "M1", "M2", "Y")], panel=panel.lm)
#violated -> bootstrap

#2. Normality -> Shap-Wilk test
fitted_values <- fitted(fit)
# Extract fitted values
if (is.list(fitted_values)) {
  # Inspect the list to find the relevant component
  names(fitted_values)  # List the names of the components

  # Example: If the fitted values are in a component named "fitted.values"
  if ("fitted.values" %in% names(fitted_values)) {
    fitted_values_y <- fitted_values$fitted.values[, "Y"]
  } else {
    # Handle other potential components
    fitted_values_y <- fitted_values[[1]][, "Y"]
  }
} else if (is.matrix(fitted_values)) {
  fitted_values_y <- fitted_values[, "Y"]
} else if (is.data.frame(fitted_values)) {
  fitted_values_y <- fitted_values$Y
} else {
  stop("Unexpected format for fitted_values.")
}
# Actual values for Y
actual_values_y <- data_combined$Y

# Calculate residuals
residuals_y <- actual_values_y - fitted_values_y

# Ensure residuals are numeric
residuals_y <- as.numeric(residuals_y)

# Print residuals to verify
print(residuals_y)
# Filter non-zero residuals if needed
non_zero_residuals <- residuals_y[!is.na(residuals_y) & residuals_y != 0]
```

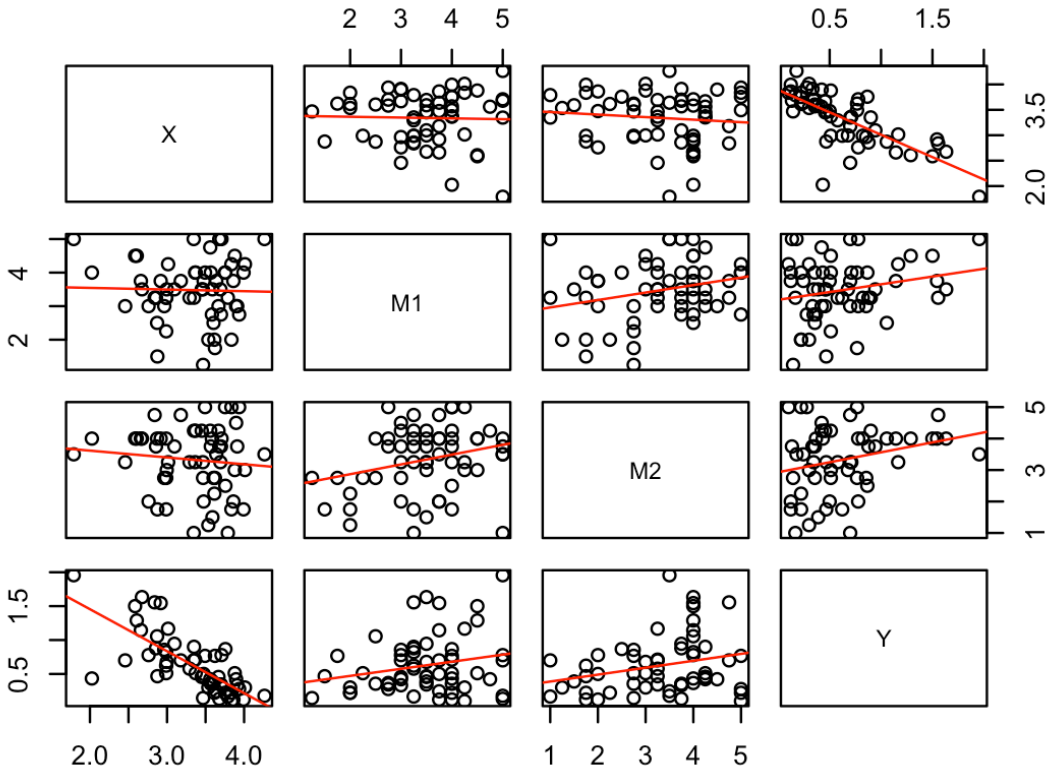
```
# Perform Shapiro-Wilk test
shapiro_test_result <- shapiro.test(non_zero_residuals)
print(shapiro_test_result)
#violated -> bootstrapping 1000

#3. Homoscedasticity
lm_fit <- lm(GSI ~ X + M1 + M2, data = data_combined)
bptest(lm_fit)
# Plot residuals vs. fitted values
plot(lm_fit$fitted.values, lm_fit$residuals,
     xlab = "Fitted Values", ylab = "Residuals",
     main = "Residuals vs Fitted Values")
abline(h = 0, col = "red")

#4. No Multicollinearity
vif_values <- vif(lm(Y ~ X + M1 + M2, data = data_combined))
print(vif_values)

#5. Independence of Observations

#SCL histogramm -> floor effect
# Create a histogram using ggplot2
ggplot(data, aes(x = GSI)) +
  geom_histogram(binwidth = 1, fill = "skyblue", color = "black") +
  labs(title = "Histogram of GSI", x = "GSI", y = "Frequency") +
  theme_minimal()
#_________mediation w/ quadratic term________
data_combined$X2 <- data_combined$X^2

sem_model <- '
  # Direct effect
  Y ~ c*X + d*X2

  # Mediator 1
  M1 ~ a1*X + a3*X2
  Y ~ b1*M1

  # Mediator 2
  M2 ~ a2*X + a4*X2
  Y ~ b2*M2

 # Indirect effects
  indirect_M1 := a1 * b1 + a3 * b1
  indirect_M2 := a2 * b2 + a4 * b2

  # Total effect
  total1 := c + (a1 * b1) + (a2 * b2) + (a3 * b1) + (a4 * b2)
'
fit <- sem(sem_model, data = data_combined, se="boot",  bootstrap=1000)
# Summarize the results
summary(fit, standardized = TRUE, fit.measures = TRUE, rsquare=T)
parameterEstimates(fit)
```

```
#_____________separate mediations_________________
data_combined <- data.frame(
  X = ffmq_total_mean,
  M1 = cerq_acceptance$mean_acc,
  M2 = cerq_rumination$mean_rum,
  Y = GSI)
#verify that combined dataframe is correct
str(data_combined)

sem_model_acc <- '
  # Direct effect of X on Y
  Y ~ c*X

  # Mediator 1 affected by X
  M1 ~ a1*X
  Y ~ b1*M1

  # Indirect effects
  indirect_M1 := a1 * b1

  # Total effect
  total1 := c + (a1 * b1)
'
# Fit the SEM model
fit <- sem(sem_model_acc, data = data_combined, se="boot",  bootstrap=1000)

# Summarize the results
summary(fit, standardized = TRUE, fit.measures = TRUE, rsquare=T)
parameterEstimates(fit)
#_____________________________________________________________
sem_model_rum <- '
  # Direct effect of X on Y
  Y ~ c*X

  # Mediator 2 affected by X
  M2 ~ a2*X
  Y ~ b2*M2

  # Indirect effects
  indirect_M2 := a2 * b2

  # Total effect
  total1 := c + (a2 * b2)
'
# Fit the SEM model
fit <- sem(sem_model_rum, data = data_combined, se="boot",  bootstrap=1000)

# Summarize the results
summary(fit, standardized = TRUE, fit.measures = TRUE, rsquare=T)
parameterEstimates(fit)

#fin
```

Appendix 2

Figure 1

Scatterplot Matrix for Linearity Assumption



Note. The scatterplot matrix visualizes the relationships between variables (X = mindfulness, M1 = acceptance, M2 = rumination, Y = GSI) to assess linearity. Each scatterplot includes a fitted regression line in red to indicate trends.