Studying Gender as Moderator for the Associations between Anxiety and Negative Events as well as Rumination and Anxiety

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Abstract

Background: Gender differences are a common topic within research. Previous studies found gender differences regarding anxiety, rumination, and negative events. However, there is a gap in the literature concerning the link between these variables, specifically, a possible moderation effect for the association between gender and these variables. To be able to analyse these variables more in-depth, the present study made use of an experience sampling method (ESM). This study aimed to validate the findings of prior research by investigating gender differences regarding anxiety and rumination while also closing the gap by analysing a possible moderation effect.

Method: The experience sampling method was used to collect data during the participant's daily life for one week. A convenient sample was gathered within the social networks of all included researchers. The final sample consisted of 28 participants of which ten were female and 18 were male. The data collection started with the participants filling out a baseline questionnaire. After that, the ESM questionnaire started and was triggered on the participant's smartphone ten times a day. The data were analysed by performing a Linear Mixed Model.

Results: The results of the study showed that females use rumination more often than men (B = -.120, $p < .001$). Nevertheless, the linear mixed model of gender and anxiety was statistically insignificant (B = .041, $p = .749$). Additionally, gender does not moderate the association between negative events and anxiety (B = -.175, $p = .252$) nor between rumination and anxiety (B = .050, $p = .714$).

Conclusion: The present study revealed that females engage more often in rumination than males, which is in line with the literature. However, no significant gender differences considering anxiety were found. The outcomes showed that gender does not moderate the relationships between negative events and anxiety as well as between rumination and anxiety. It is important to note that these findings are based on a small sample size. The study can serve as starting point for further investigations of gender differences by examining data from daily life. Further research can add to this research by repeating and expanding the study to gain more knowledge and in-depth insights.

Contents

Studying a Moderation Effect of Gender on the Relationships between Anxiety and Negative Events as well as Rumination and Anxiety

Anxiety

There are various emotions with different influences on an individual. Anxiety is an emotion linked to high arousal and excessive worrying (Remes et al., 2016). Anxiety disorders represent the inability to successfully carry out an adaptive response or engage in maladaptive responses to an arising situation (Amstadter, 2008). In the European Union alone, anxiety disorders are the most prevalent psychiatric condition as more than 60 million individuals are diagnosed with an anxiety disorder each year (Wittchen et al., 2011). They greatly burden an individual and can increase the likelihood of developing mood disorders, substance abuse, and other anxiety disorders (Remes et al., 2016). The effects of (chronic) anxiety are expressed primarily in the thoughts and behaviour of an affected person. Particularly, specific cues are perceived as threatening due to threat biases, which can lead to negative thoughts about this cue up to avoidance behaviour (Britton et al., 2010). Hence, anxiety disorders can interfere with the normal functioning of an individual as simple cues can already be perceived as a threat. This highlights the importance of further investigating anxiety and anxiety disorders to gain more insights into one of the most common psychiatric conditions.

Emotion Regulation

Individuals handle arising emotions very differently, based on their emotion regulation. Emotion regulation (ER) describes the process of influencing emotions in oneself or others regarding time limits, situational bonds, and positive or negative states (Gross & John, 2003; McRae & Gross, 2020). Emotion regulation starts with the identification of a discrepancy between the emotional current- and the desired emotional state of the individual (Gross, 2015). Following that, emotion regulation occurs by selecting one of the ER strategies, namely avoidance, direct request, distraction, rumination, cognitive reappraisal, acceptance, expressive suppression, and physiological intervention (Gross, 2015). Important to point out is that ER strategies can work as maladaptive or adaptive responses depending on the context. After the selection process, a specific strategy is implemented which is then monitored to realize success or failure in achieving the regulatory goal. Consequently, it can be assumed that individuals differ in their emotion regulation as they could select different strategies, which can in turn have a different influence on the whole situation and the individual.

These differences are also recognizable when considering psychopathology. According to Mennin et al. (2007), anxiety can be seen as a result of difficulties in emotion regulation. Particularly, if an individual is not able to handle daily situations adaptively over a long period, diagnosable anxiety can arise. Additionally, the wellbeing of an individual can decrease because of maladaptive emotion regulation as well (Kraiss et al., 2020). This points out that emotion regulation plays a great role in individuals' psychological health, as maladaptive emotion regulation negatively influences an individual's health.

Rumination as a Specific ER Strategy and its Role for (Regulating) Anxiety and Potential Role in Anxiety Disorders

One of the maladaptive strategies is rumination. Rumination can be described as repetitive and negative thinking of the self, one's emotions, and personal concerns and experiences (Watkins, 2008). Especially the ER strategy of rumination was found to be a predictor for the perception of emotional distress in chronic illness as well as for poor physical health (Soo et al., 2009). Furthermore, the study of Aldao et al. (2010) revealed that rumination is positively associated with anxiety and has large effect sizes for overall psychopathology. This is the case because individuals who often engage in rumination experience more negative emotions and with greater intensity (Ye et al., 2020). Besides, anxiety disorders share the symptom of excessive worrying which is related to rumination (Harrington & Blankenship, 2002). Therefore, rumination was established as a predictor for anxiety symptoms (Nolen-Hoeksema, 2000). Consequently, rumination hinders the process of successful adaptation to a specific situation or problem-solving (Ye et al., 2020). Concludingly, research provides evidence for the importance of targeting the ER strategy of rumination more in-depth when focusing on anxiety (disorders).

Negative Events and Anxiety

The environment could also be a crucial factor influencing emotions and emotion regulation. According to Taylor (1991), the encounter of positive or negative life events can result in different behavioural, cognitive, physiological, and affective outcomes for an individual. Moreover, it was found that negative events have a greater influence on bodily changes than neutral or positive events. Relevant to successful adaptation to negative events is resilience. Resilience can be described as "one's ability to actively adapt and cope with the impact of stress or trauma" (Ye et al., 2020). Hence, having a high level of resilience can serve as a buffer against negative effects on an individual as it lets individuals recover quickly

from challenges or difficulties such as negative events (Tugade et al., 2004). Therefore, resilience is important in successfully adapting to and overcoming negative events.

A negative life event can be defined as a situation that "creates adverse outcomes for the individual" (Taylor, 1991). Apart from greater influences on bodily changes, negative life events also increase the vulnerability of suffering from an illness (Taylor, 1991). A study by Baumeister et al. (2001) established that negative events have a stronger impact on subjective wellbeing than positive events. Next to subjective wellbeing, negative events can increase the likelihood of developing and/or increasing psychological problems (Breslau et al., 1999, as cited in Seery, 2011). Therefore, it can be assumed that experiencing negative events in daily life can also increase anxiety as it negatively affects an individual's mental health and wellbeing.

Gender as a potential Moderator

Demographic differences are known to influence various relationships in research. Especially when taking into account the gender of an individual, it was found that women are more likely to experience anxiety and to be diagnosed with an anxiety disorder than men (e.g. Bandelow & Michaelis, 2022; Kessler et al., 2007; McLean et al., 2011). A recent study by Bandelow and Michaelis (2022) underlines the statement as this study also revealed that the prevalence of anxiety disorders among females is twice as high as for males. Focusing on rumination, the most striking difference between women and men in terms of the selection of ER strategies is that women are more likely to engage in rumination (Nolen-Hoeksema, 2012). Hence, it could be interesting to get further insights into whether gender moderates the relationship between rumination and momentary daily anxiety, as gender differences are found for anxiety as well as for rumination.

Nevertheless, no gender differences were found for resilience (Lundman et al., 2007). However, it is still worth investigating the impact of negative events, as it was found that females tend to evaluate their life events more negatively and less controllable than men do (Matud, 2004). Consequently, literature provides insight into links between gender differences in anxiety and gender differences in experiencing negative events. However, there is a gap in the literature for a possible moderation effect of Gender. Hence, it is worth investigating whether gender moderates the relationship between negative events and anxiety.

Experience Sampling Method

To be able to effectively assess emotions, strategies, and context in daily life with its possible daily and momentary changes, an experience sampling methodology (ESM) is most

beneficial. ESM studies provide the opportunity to explore self-reports of specific experiences "within, and in interaction with, the real-world context" (Myin-Germeys et al., 2018). Hence, ESM studies can assess context, which is especially important when analysing variables like negative events. Due to this opportunity, reliance on long-term memory can be prevented so that participants do not have to recall experiences from the past (Van Berkel et al., 2017). Moreover, by being able to assess data over a longer period, investigations of associations of variables over time are possible (Myin-Germeys et al., 2018). Additionally, there is evidence that ESM studies provide short- and long-term reliability and validity (Csikszentmihalyi & Larson, 2014). Consequently, using an experience sampling methodology can be supportive in being more reliable and can lead to greater generalizability to daily life as many different variables can be assessed more frequently within the daily lives of the participants.

Present Study

Building on previous research, based on the findings and gaps in the literature, the present study will focus on a possible connection between the variables gender, anxiety, rumination, and negative events. Considering the findings of the literature it can be expected that females experience more levels of anxiety and engage more often in rumination than males. Based on that, it can be assumed that being a female might positively influence the relationship between negative events and momentary anxiety. Lastly, as the literature already provided some insights, it can be expected that this study will also reveal that being a female positively influences the association between rumination and momentary anxiety. This can be analysed with four research questions:

RQ1: Do females and males differ in the amount of anxiety experienced in daily life?

RQ2: Do females and males differ in the frequency of engaging in rumination in daily life?

RQ3: Does gender moderate the relationship between negative events and momentary anxiety?

RQ4: Does gender moderate the relationship between rumination and momentary anxiety?

Methods

Participants

A convenient sample was collected by spreading the study around the social networks of all included researchers. Convenience sampling is a non-probability sampling method of choosing easily available participants (Taherdoost, 2016), for example, family or friends. As motivation seems to be a crucial factor for filling out enough questionnaires over the days and

filling them out thoughtfully (Napa Scollon et al., 2009), using a convenient sample can increase the likelihood of motivation of participants as they were specifically asked if they would like to be part of the study. The study aimed for 50 participants or more as the social network of seven researchers were involved and in ESM studies, a sample size consisting of fewer than 50 participants is referred to as a "two-level" sample size, which could lead to second-level standard errors (Yu et al., 2020). The inclusion criteria for this study were having a smartphone with an internet connection (Android or IOS) and a sufficient English level as the study was conducted in English.

Materials

The data for this study was collected via the research platform Ethica Data (www.ethicadata.com). This platform is a smartphone application and is available for IOS and Android. A baseline questionnaire was included before starting the daily ESM study. The daily ESM questionnaires were sent to the participants via the Ethica application on their mobile phones. The baseline and ESM questionnaires also contain scales irrelevant to this research, as more researchers were involved. For this study, only the following relevant scales of the baseline questionnaire and the ESM questionnaires were analysed.

Baseline Questionnaire

Demographics. To be able to differentiate between females and males, and to generally say something about the characteristics of the participants, demographic questions were asked at the beginning of the baseline questionnaire (Appendix A). These questions assessed age, gender, nationality, occupation, and the highest degree obtained by the participant.

ESM Questionnaires

Anxiety. For the assessment of momentary anxiety, the ESM study will ask for the participants' current positive and negative affect (Appendix B). The participants were asked to indicate their current level of anxiety and response categories were provided on a 7-point Likert scale ranging from "not at all" to "very much". This item was already used in other ESM studies as well (e.g., Ludwig et al., 2020). A split-half reliability was performed by calculating the person-mean scores for two halves of the study (3 days and 4 days). Both person-mean scores were correlated which resulted in a split-half reliability coefficient of .80. For the validity, person-mean scores were correlated with trait measures (GAD-7 baseline measure) of the same construct which resulted in a correlation of .37 ($p = .056$).

Negative event. For determining momentary negative events, participants are asked to think of the most striking event/activity in the last hour and rate this event as pleasant or unpleasant. The item and its response categories were already used in other ESM studies as well (e.g., Lardinois, 2011). The response categories were provided on a bipolar scale ranging from -3 to +3 ("very negative" to "very pleasant") (Appendix C).

Rumination. Rumination was measured by asking how the participants dealt with the previously negatively indicated event (Appendix C), as rumination is a strategy focusing on negative events only. Relevant to this study will be the answer "I kept thinking about it", as this belongs to the strategy of rumination. This item was chosen because it has already been used similarly in other ESM studies (Blanke et al., 2022; Ludwig et al., 2020). The response categories were provided on a nominal scale including "Yes" and "No". For rumination, a split-half reliability was performed as well by calculating the person-mean scores for two halves of the study (3 days and 4 days). Both person-mean scores were correlated which resulted in a split-half reliability coefficient of .80. For validity, the person-mean scores of the same construct of the trait measure (CERQ) were correlated which resulted in a correlation of -.14 ($p = .475$).

Design and Procedure

The participants for the study were recruited by all involved researchers (A. Brot, A. Schaffert, C.L.B. Landefeld, J. Diephaus, J. Höting, L. Schwemin, N. Feldbusch). Before the start, all participants were sent an invitation and a written briefing for the study, and the procedure via mail one week before the start by the supervisors. The data collection started on Monday, 13.02.2023, and went on for seven days.

The selection and set up of the questionnaires in the Ethica application were done by the supervisors of the research group beforehand. The study received ethical approval from the Committee of the Faculty of Behavioural Management and Social Science at the University of Twente (number: 230038). The design choice of using the Ethica application is beneficial for this study as the accuracy of collecting "in-the-moment" data becomes greater by using smartphones (van den Heuvel et al., 2021). Besides, the application provides the opportunity to set a time frame for the questionnaires to prevent participants from filling out a questionnaire later to prevent memory recall bias (Dejonckheere & Erbas, 2022).

In total, the baseline questionnaire included five demographic questions and eight scales. The baseline questionnaire was the start of the study, took around 20 minutes, and did not expire. A reminder followed after eight, 24, and 72 hours. The ESM questionnaires were triggered 10 times a day at random moments between 7.30 am and 10.30 pm in blocks of 90

minutes for one week. According to Eisele et al. (2022), a high sampling frequency when collecting data using ESM studies does not increase the burden on an individual. Hence, the present research focuses on more questionnaire triggers a day instead of increasing the length of the study. It was the same questionnaire for all 10 times and included seven topics, each with one to two questions. Filling out the questionnaires took around two minutes. Due to the quantity, no reminders were set, and the questionnaires expired after 15 minutes.

Data Analysis

The necessary steps for the data analysis of this study adhered to established guidelines (Meteyard & Davies, 2020) for the use of linear mixed models. After closing the ESM study on Ethica after one week of data collection, the data was imported from the Ethica application to the statistical software "IBM SPSS statistics" for the analysis. First, the data needed to be corrected by excluding participants with a response rate lower than 33.33% as this cut-off score is a recommended minimum required response rate for ESM studies (Viechtbauer, 2022). For preparing the analysis, a dummy variable was created for the variable "negative events", for which the response categories -3 to -1 were recoded to "1", indicating a negative event occurred for the participant. Hence, the response categories 0 to 3 were recoded to "0" to be the reference category indicating the absence of a negative event. As this study focuses on gender differences, a dummy variable was created for the variable gender as well. Since it can be assumed that females will experience more anxiety and engage more often in rumination than males, "female" was recoded to "1" and "male" was recoded to "0", being the reference category. Lastly, another dummy variable was created for rumination as "yes" was recoded to "1", indicating a participant engaged in rumination, and "no" was recoded to "0", representing that no rumination was used.

After that, a linear mixed model (LMM) was performed to examine and answer the research questions of this study. According to Viechtbauer (2022), using a linear mixed model is beneficial and very common when implementing an ESM study or analysing longitudinal studies in general. Besides, linear mixed models are necessary because repeated measures make the data nested (Boisgontier & Cheval, 2016). Besides a random intercept model was used. An autoregressive covariance structure AR(1) was used for every linear mixed model as this structure "describes the degree of similarity among repeated observations" (Barnett et al., 2010). To answer the first research question, whether females and males differ in their average levels of experiencing momentary daily anxiety, an LMM was used with gender being the independent variable and anxiety the dependent variable. Secondly, to explore whether females do engage more often in rumination than males, an LMM was used with

gender being the independent variable and rumination being the dependent variable. To check for the third research question of whether gender moderates the relationship between negative events and anxiety, an LMM was performed with negative events as fixed factor, gender as fixed factor, and anxiety as the dependent variable. Specifically, the variables negative events and gender were separately included as main effects and together included as interaction effect. To analyse whether gender moderates the relationship between rumination and anxiety, an LMM was also performed with rumination as fixed factor, gender as fixed factor, and anxiety as the dependent variable. Similar to the third research question, rumination and gender were individually included as main effects and together as interaction effect.

Results

The sample consisted of 88 participants in total. A power analysis to estimate the minimum required sample size was performed. The estimated sample size needed to find significant outcomes was 84 participants, based on an Alpha level of .05 and a desired power of .80. After the correction of data, the final sample included 28 participants. 60 participants had to be removed because of a low response rate ($< 33.33\%$) and/or not filling out the baseline questionnaire. In the final sample, 10 (35.7%) were female and 18 (64.3%) were male. The age ranged from 18 to 53 ($M = 23.39$, $SD = 6.64$). Of all participants, 16 (57.1%) were German, 10 (35.7%) were Dutch and 2 (7.1%) had other nationalities. The majority were students (60.7%). Table 1 provides an overview of the sample characteristics.

Table 1

Sample Characteristics

		Females			Males		
		N	*M*	*SD*	*N*	*M*	*SD*
Gender		10			18		
Age			24.2	2.53		22.94	8.13
Nationality	German	5			13		
	Dutch	3			5		
	Other	2			0		
Occupation	Student	5			14		
	Working	0			1		

	Self-employed	2	0
	Studying and working	3	2
	Not working	0	1
	Other	0	0
Education	Middle School	1	0
	High School	3	11
	Bachelor	5	6
	Master	1	0
	PhD	0	0
	Other	0	1

Research Question 1

   For the first research question, the association between gender and anxiety was not statistically significant ($p = .749$). This indicates that females and males do not differ in their levels of experiencing momentary daily anxiety. Figures 1 and 2 illustrate the relationship between gender and anxiety.
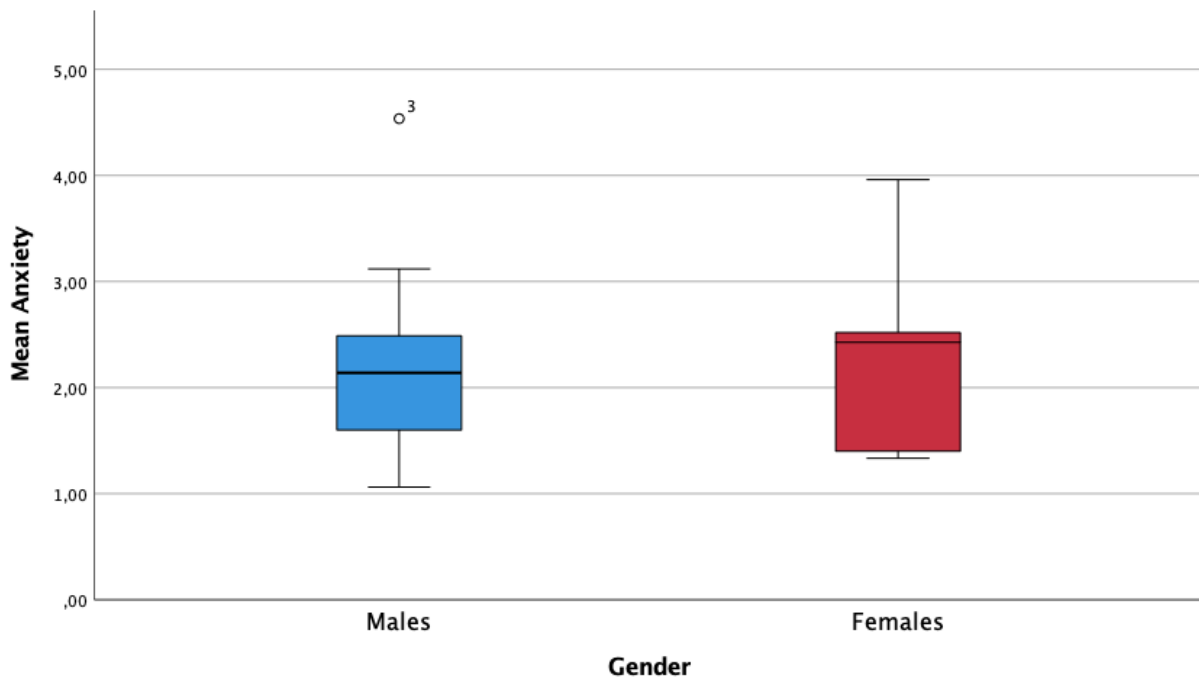
Figure 1

Bar Chart Displaying the Relationship between Gender and Daily Anxiety
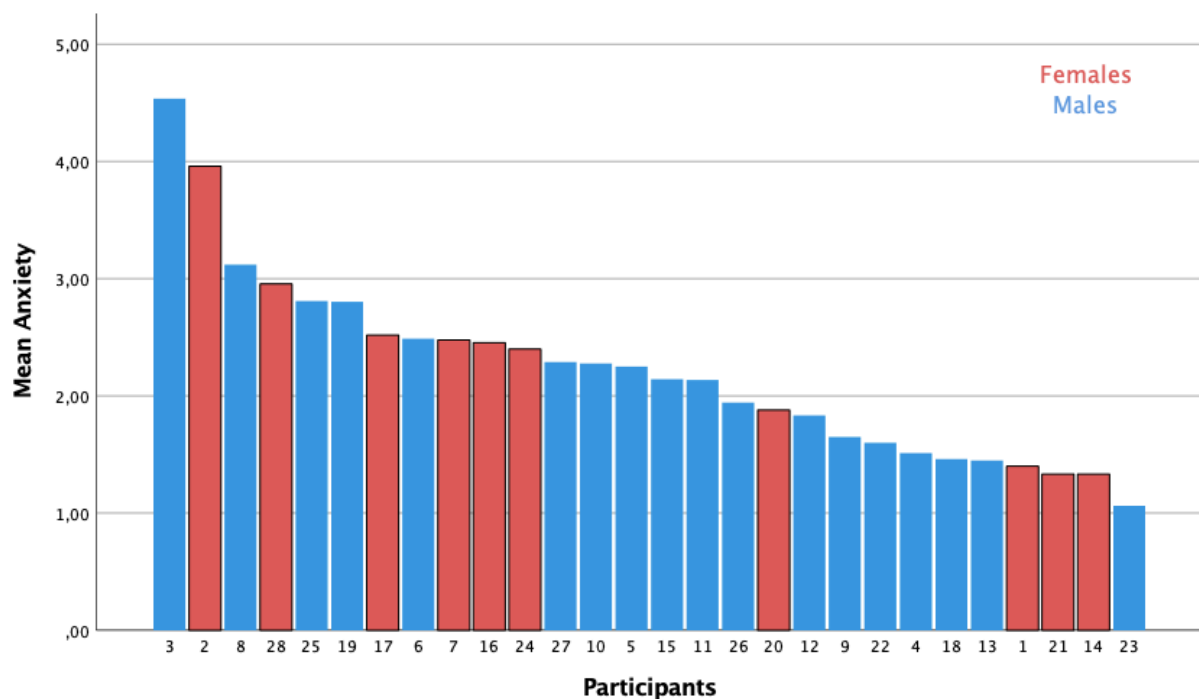
Note. The red bars represent female participants ($M = 2.27$, $SD = 0.83$), and the blue bars represent male participants ($M = 2.19$, $SD = 0.80$).

Figure 2

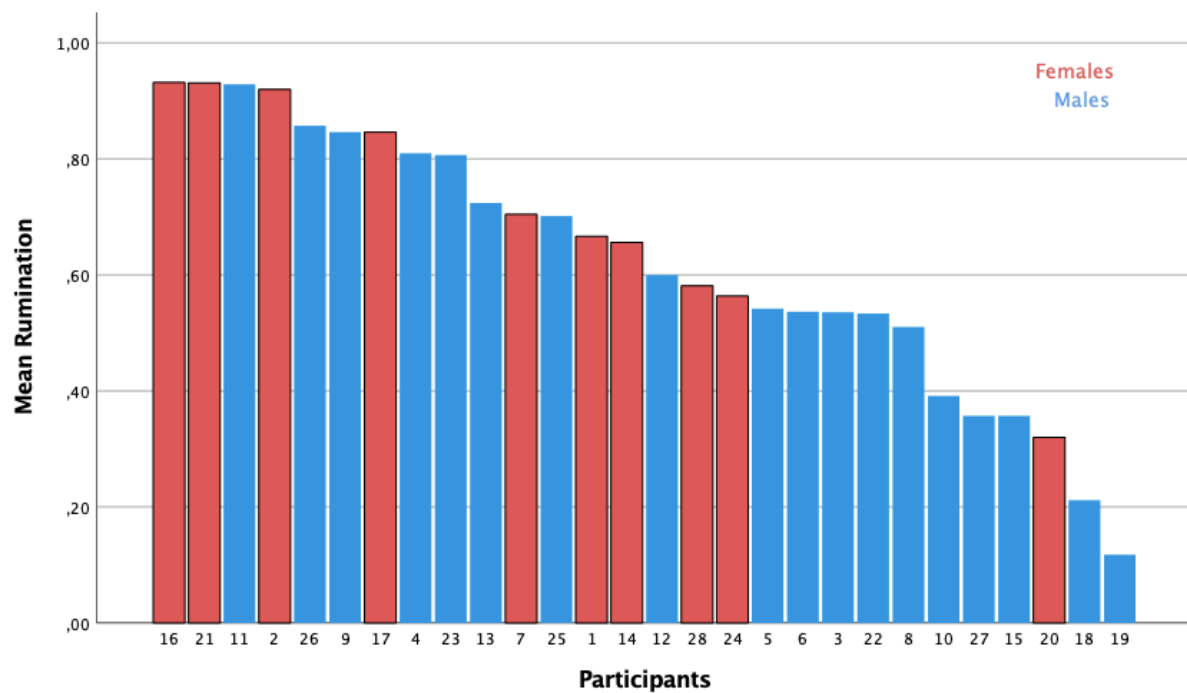*Boxplot Displaying the Relationship between Gender and Daily Anxiety*

Note. The red boxplot represents female participants ($M = 2.27$, $SD = 0.83$), and the blue boxplot represents male participants ($M = 2.19$, $SD = 0.80$).

Research Question 2

The linear mixed model of the second research question to analyse whether females and males differ in the frequency of engaging in rumination in daily life was statistically significant ($p < .001$). The results show that females do engage more often in rumination than men ($B = -.120$, $t = -3.21$). This outcome reveals that gender is associated with people engaging in more rumination. Figures 3 and 4 aim to show the results of the second research question by demonstrating the relationship between gender and rumination. Additionally, table 2 provides an overview of all corresponding information on the models for the first and second research questions.

Figure 3

Bar Chart Displaying the Relationship between Gender and Daily Rumination

Note. The red bars represent female participants (*M* = 0.71, *SD* = 0.20), and the blue bars represent male participants (*M* = 0.58, *SD* = 0.23).
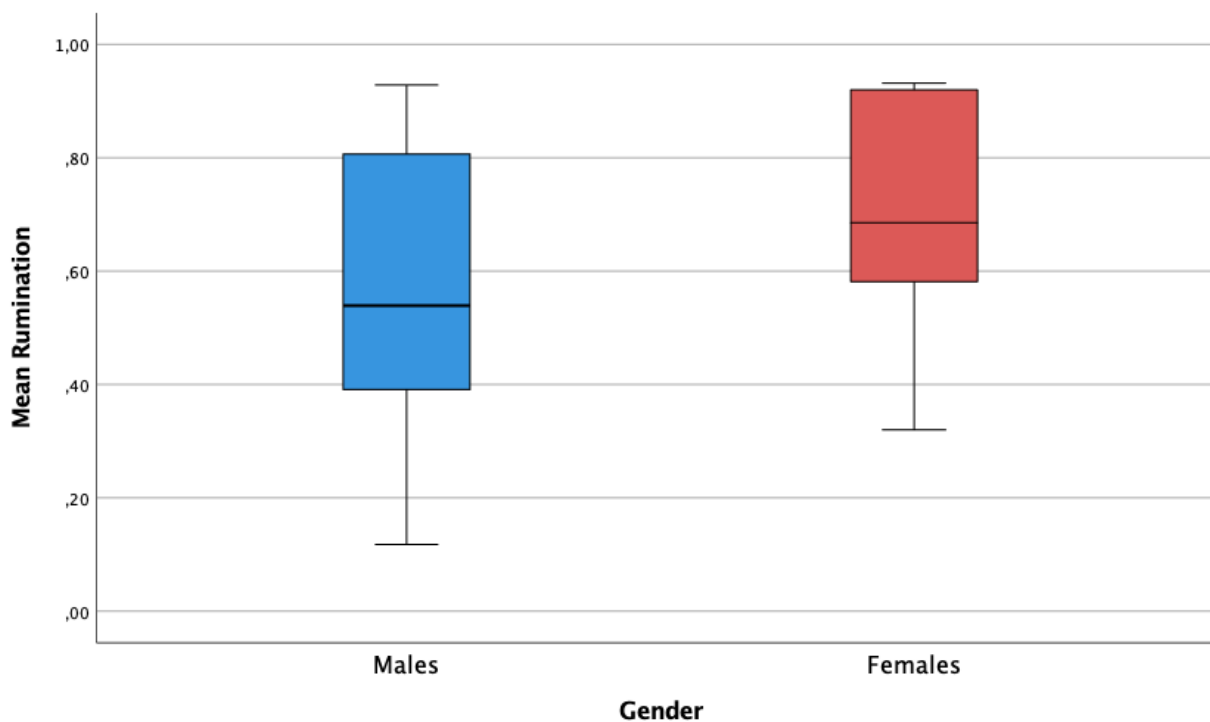
Figure 4

Boxplot Displaying the Relationship between Gender and Daily Rumination

Note. The red boxplot represents female participants ($M = 0.71$, $SD = 0.20$), and the blue boxplot represents male participants ($M = 0.58$, $SD = 0.23$).

Table 2

Overview of the Estimates of Fixed Effects for the First and Second Research Questions

Variable	B	SE	t	p	95%CI
Gender[a]	.041	.130	.320	.749	[-.214, .297]
Gender[b]	-.120	.037	-3.209	.001	[-.193, -.046]

Note. a. Research Question 1, Dependent Variable: Anxiety

   b. Research Question 2, Dependent Variable: Rumination

Research Question 3

The main effect between negative events and anxiety of the linear mixed model was statistically significant ($B = .660$, $t = 6.91$, $p < .001$). However, the interaction effect with gender being the moderator was statistically insignificant ($p = .184$). Hence, the association between negative events and anxiety does not depend on gender.

Research Question 4

The main effect between rumination and anxiety of the linear mixed model was statistically significant ($B = .240$, $t = 2.84$, $p = .005$). Nonetheless, gender did not moderate the relationship between rumination and anxiety as the interaction effect was statistically insignificant ($p = .908$). Table 3 provides an overview of the findings for the moderation analyses of the third and fourth research questions.

Table 3

Overview of the Estimates of Fixed Effects for the Third and Fourth Research Questions

Variable	B	SE	t	p	95%CI
Negative Events	.660	.096	6.908	<.001	[.473, .848]
Gender	.114	.127	.894	.372	[-.137, .364]
Gender*Negative Events	-.209	.157	-1.328	.184	[-.517, .100]
Rumination	.240	.085	2.842	.005	[.074, .406]
Gender	.084	.137	.615	.539	[-.186, .354]

Gender*Rumination	.017	.145	.115	.908	[-.268, .302]

Note. Dependent Variable: Anxiety

Discussion

This study aimed to use the experience sampling method to investigate possible differences in gender and anxiety and gender and rumination in daily life. Additionally, it was examined whether gender moderates the association between negative events and anxiety and between rumination and anxiety. The results revealed that females engage more often in rumination than males. However, the findings did not disclose statistically significant gender differences in the experience of anxiety in daily life. Furthermore, it was found that gender does not moderate the associations of negative events and anxiety or rumination and anxiety. However, the moderation analyses indicate that there is a positive relationship between negative events and anxiety as well as between rumination and anxiety.

Main Findings

Previous studies showed that gender greatly influences the levels of anxiety experience. Specifically, it was found that females undergo higher levels of anxiety and suffer more often from anxiety disorders than men (Bandelow & Michaelis, 2022; Kessler et al., 2007; McLean et al., 2011). Therefore, the first research question of the present study analysed whether females and males differ in the amount of anxiety experienced in daily life. The findings revealed that there are no significant gender differences regarding the amount of anxiety experienced in daily life. An explanation may be that the difference in gender with respect to anxiety is not large enough to show significant differences in this study. According to McLean et al. (2011), the lifetime prevalence of anxiety disorders is only slightly higher for women (23.4%) than for men (19.3%). Hence, it could be argued that the small difference could lead to the results of the present study. Besides, as the final sample of the present study consisted of more men than females, it could be assumed that the outcomes are balanced out which could have led to no significant gender differences. Moreover, as only one item of the questionnaire of the ESM study was used, it is possible that this item was not sensitive enough. Specifically, only a moderate association was found between the item of the ESM questionnaire and the GAD-7, which assess anxiety more comprehensively. Especially since anxiety is rather complex (Barlow, 2004), a less sensitive item could not be enough to assess anxiety sufficiently and potential gender differences in a small sample.

The second research question dealt with the differences in gender in the frequency of engaging in rumination in daily life, as literature provides insight that females use rumination

as an emotion regulation strategy more often than men (Nolen-Hoeksema, 2012). The results of the present study are in line with the findings, as it was found that females engage more often in rumination than males. On the one hand, an interpretation of this insight can be that it was also found in previous literature that due to differences in socialisation, males are encouraged to use strategies that are related to problem-focused coping (McRae et al., 2008). Therefore, cognitive reappraisal is used more among males, whereas females are more likely to engage in rumination. On the other hand, the present study sample included more male participants than females, which could also influence the outcomes as more men answered the item for rumination with "no".

Literature also revealed that females appraise life events more negatively (Matud, 2004). Besides, a study by Taylor (1991) analysed that negative events have more impact on an individual than positive ones and increase vulnerability to psychological problems. Therefore, negative events can lead to higher levels of anxiety. Hence, it was assumed for the third research question of this study that gender moderates the relationships between negative events and anxiety. However, the results are inconsistent with the assumption as no moderation effect of gender was found. Additionally, previous findings examined that anxiety results from maladaptive responses, for example, rumination, due to difficulties in emotion regulation (Amstadter, 2008; Mennin et al., 2007; Nolen-Hoeksema, 2000). Hence, there is evidence of a link between rumination and anxiety. Thus, the fourth research question dealt with the analysis of a possible moderation effect of gender on rumination and anxiety. The outcome showed that the relationship between rumination and anxiety also does not depend on gender. An interpretation for both moderation analyses can be that gender differences in behaviours or coping styles cannot be absolute, but just more common in one gender (Altemus et al., 2014). Particularly, even though literature provides evidence for gender differences, it is seldom possible to conclude these outcomes solely on gender as environmental, social, and/or cultural influences can never be completely ruled out. Besides, a study by Hettema et al. (2005) revealed that females and males do not differ in genetic risk factors considering anxiety (disorders). Consequently, no moderation effect was found with respect to gender as other factors such as other genetic factors, environmental, and cultural factors could not be considered or excluded from this ESM study.

Strengths and Limitations

As with any study, some strengths can be pointed out, and limitations must be considered. Specifically, using an ESM study when analysing gender differences concerning anxiety, negative events, and rumination, is very beneficial to gather data daily for a longer

period. As the level of daily anxiety can change due to specific possible events/situations or environmental influences, it is worth investigating the differences in gender within a longer period. Besides, negative events and whether rumination is going to be used for that specific situation are also momentary. Especially considering negative events, using an ESM study is valuable as it prevents memory biases, as no past events must be recalled by the participants (Van Berkel et al., 2017). Therefore, the design choice of using an ESM study is favourable for context-related and situational variables.

On the one hand, another strong point of this study is that most participants were students. As it was found that students experience high levels of anxiety and stress (Bayram & Bilgel, 2008), it is beneficial to study anxiety and negative events among students. Moreover, the emotion regulation strategy of rumination significantly affects students' anxiety and procrastination levels (Constantin et al., 2018). Hence, investigating these variables within a sample with mainly students can be very supportive in gaining useful insights. On the other hand, the convenience sampling method belongs to nonprobability sampling as it does not provide a representative of the population because of its nature to directly choose participants (Etikan et al., 2016). Most of the participants were students, which underlines the statement that convenience samples are often homogeneous (Etikan et al., 2016). Choosing a probability sampling method would have increased randomness and generalizability.

Furthermore, an important limitation that must be considered is the sample size of this ESM study. Although the lowest possible response rate (1/3) was used for the data-cleaning procedure, the final sample consisted of only 28 participants. A greater sample size would have been more convenient to have enough adequate power to receive significant results (Chan, 2003). Especially when analysing gender, an appropriate sample size is important, as the final sample size is further divided into groups.

Another limitation is the number of questionnaires during the ESM study. Even though a higher sampling frequency is more beneficial than a longer sampling period (Eisele et al., 2022), it can still be perceived as a burden for many participants. As ten questionnaires a day interfere with an individual's life, the burden of answering these is considered an ethical issue related to ESM studies (Kirtley, 2022). Additionally, because of the number of questionnaires the participants could have been getting used to the questions and starting to answer carelessly (e.g. Beal, 2015; Dension, 2022), which cannot be checked for. This is problematic regarding the outcomes of the study as careless responses could have affected the results, especially when taking the variable "negative events" into account.

Implications

Despite the mentioned limitations, this study can suggest theoretical and practical implications. For the theoretical aspects, the outcomes imply that the links between rumination and anxiety, as well as negative events and anxiety, may be influenced by other factors. As no significant differences in gender were found in anxiety and relationships, gender cannot be seen as a potential moderator. A study conducted by Seedat et al. (2009) found that gender differences remain stable, but the differences begin to narrow in depression and substance abuse disorder because the roles of males and females become more equal. This insight and the outcomes of this study suggest that this narrowing could also apply to other mental health disorders.

Therefore, these data have some practical implications concerning gender differences as well. The literature has studied the effect of gender biases and their negative outcomes before (e.g. Heilman, 2012; Ridgeway & Correll, 2004). Gender biases lead to treating women and men differently, for example, at work or social contexts. Hence, the results have potential implications as gender differences regarding the present variables are seemingly not absolute. Individuals must therefore pay attention not to treat females and males differently in expectations about anxiety or rumination, for example. On the one hand, staying in the workplace scenario, tutors within schools/universities or superiors within workplaces should use these insights to not treat a female softer just because she is expected to ruminate more or experience more anxiety. On the other hand, tutors and superiors should not treat a male harder as he is expected to not engage in rumination or experience high levels of anxiety. However, considering the sample size limitations, these practical implications should be interpreted tentatively. The results could serve as a starting point to prevent gender biases, possible stereotypes, and too differentiated thinking regarding gender differences.

Future Research

Regarding future research, it would be beneficial to extend the present study's findings by examining the variables within a larger sample. Future research could replicate this ESM study with a larger sample to minimize the limitations of this present study. As the power analysis revealed that a sample size of 84 is needed, future research should aim for that size or larger. Additionally, a suggestion to prevent or limit careless responses during an ESM study could be using different orders or wordings for an item as this could avoid habituation and maintain focus and attention.

Another important part of future research would be testing other possible third variables. As the results revealed that the main effects (rumination on anxiety and negative

events on anxiety) were significant and positive, it would be interesting to further investigate which factors could increase or decrease the relationships. As mentioned, environmental, social, and/or cultural contexts are potential variables that also play a role as additional moderators (Altemus et al., 2014). Consequently, future research could include these factors by specifying the inclusion criteria for the sample. For example, researchers could check for cultural differences by grouping the sample based on their cultural background. The researchers could then group the sample according to socioeconomic status to also check possible social influences. Furthermore, the present study did not differentiate between high levels of anxiety and anxiety disorders, which could also be an interesting addition to this study. By doing so, differences in clinical anxiety and high levels of anxiety regarding rumination and negative events could be concluded.

Conclusion

Many gender differences are known regarding various aspects of our personalities and lives, as well as for variables such as anxiety, rumination, and negative events. The study analysed whether gender moderates the association between negative events and anxiety as well as between rumination and anxiety as there is a gap in the literature concerning these links. The results provided the insights that gender differences were only found in rumination, but not in anxiety and both moderation analyses. Nevertheless, because of the limitations, this study can be seen as a starting point for further analyses of these links and possible other factors influencing anxiety, emotion regulation strategies such as rumination, and negative events. By doing so, more knowledge can be gained about risk factors and the impact of gender in general. Concludingly, this study provides insights into the idea that gender differences are not as common anymore as they used to be in daily life.

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Appendix A

Demographic Questions

- Age: How old are you?
- Gender: What gender do you identify as? Male, female, Other
- Nationality: What is your nationality? Dutch, German, Other
- Occupation: What is your current occupation? Student, Working, Self-employed, Studying and working, Not working, Other
- Highest degree obtained: Middle school (such as MBO, MTS, MEAO or Haupt- oder Realschule), High school (such as HAVO, VWO, HBS or Gymnasium/Berufsschule/Berufskolleg), Bachelor, Master, Ph.D., Other

Appendix B

Positive and Negative Affect (Anxiety)

Below you can find several questions about your current feelings. Please try to indicate how you felt right before you started to answer the questionnaire!

- How *cheerful* do you feel right now?
- How *enthusiastic* do you feel right now?
- How *satisfied* do you feel right now?
- How *relaxed* do you feel right now?
- How *anxious* do you feel right now?
- How *irritable* do you feel right now?
- How *down* do you feel right now?
- How *guilty* do you feel right now?
    - 1 (not at all) to 7 (very much)

Appendix C

Stressful Event + Coping Questions

Think of the most striking event or activity in last hour. How (un)pleasant was this event or activity?

- -3 (very unpleasant) to +3 (very pleasant)

How did you deal with this event?

- I kept thinking about it (rumination/savoring)
- I tried to distract my attention from it (distraction)
- I expressed my emotions (emotion expression)
- I talked to others about it (social support seeking)
- I tried to look at it in a different way (positive/negative reappraisal)
    - Yes/no