Universiteit Utrecht

July, 2018

The relationship between Intolerance of Uncertainty and State-Eating Pathology in Patients with Anorexia Nervosa

Master Thesis Clinical & Health Psychology

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Abstract – There is a great amount of evidence from previous studies that found intolerance of uncertainty (IU) to be related to different psychological disorders. However, there is little known about the relationship between IU and the eating disorder: Anorexia nervosa (AN). The primary purpose of the study was to examine whether experimental induction of IU would have an effect on state-eating pathology in patients with AN versus those who did not undergo an experimental induction of IU. 29 Participants (M = 23.97, SD = 6.54) filled out a visual analogue scale about the experienced feeling of uncertainty, a questionnaire about state eating pathology and a questionnaire about intolerance of uncertainty before and after the experimental induction of IU. Results show that the manipulation did not show a difference between the group that underwent the experimental induction of IU versus the group that did not. Further research is needed to replicate this study and investigate the relationship IU has with AN.

Introduction

Eating disorders such as Anorexia Nervosa (AN) and Bulimia Nervosa (BN) are psychological illnesses with far greater mortality rates compared to other mental disorders (Arcelus, Mitchell, Wales & Nielsen, 2011). Eating disorders are characterized by a clear disturbance in weight-control behavior or eating habits which result in a significant deterioration of psychosocial function or psychological health (Fairburn, Harrison, 2003).The incidence of eating disorders and especially AN are increasing among individuals with various cultural, ethnical and racial backgrounds across the world (Pike, Hoek & Dunne, 2014). According to a study of Hoek and Vandereycken (2008) approximately 370 out of 100.000 woman in the Netherlands suffer from AN. In addition the overall incidence rate of AN in the Netherlands was 6 per 100.000 person-years in the period 2005-2009 (Smink, van Hoeken, Donker, & Susser, 2016). Perhaps this is an underestimation because individuals with AN do not seek help easily because they are ambivalent at best (Hoek & Vandereycken, 2008). AN is seen mostly among adolescent girls and women (Hoek & van Hoeken, 2003). Individuals suffering from this disorder are unable to maintain a healthy body weight (Body Mass Index: BMI), experience an intense fear of weight gain, have a low self-esteem, use different drastic methods to control their weight and have altered cognitions and emotions (American Psychiatric Association, 2013). Therefore, it is a disorder that impacts the mind as well as the body (Bulik, Reba, Siega-Riz, & Reichborn-Kjennerud, 2005). Individuals that suffer from AN experience problems on various areas in life. One in four people with AN do not have paid employment (Zipfel, Giel, Bulik, Hay & Schmidt, 2015). The severity of AN and the suffering that goes along with the disorder is proved by the high mortality rates as shown in the study of Arcelus et al. (2011). The high mortality numbers of individuals that suffer from AN are explained by suicide, substance abuse and as the result of the damage that AN inflicts on the physical health (Papadopoulos, Ekbom, Brandt & Ekselius, 2009).

Therefore it is clear that AN is a severe mental disorder and that there is a sense of urgency to examine the personality traits, risk factors and underlying mechanisms in people with AN. Although the etiology so far remains elusive, several factors are become more clear. Pike and colleagues (2014) found that the increase of the incidence of AN worldwide is associated with the increase of urbanization, globalization and industrialization. This could explain why eating disorders are overrepresented in the western world in comparison to so called ‘third world countries.’ Research also shows that individuals with an eating disorder have distinctive patterns of behavior. The distinctive patterns of personality were exhibited in less joy, less trust and more feelings of negative affectivity (Levallius, Clinton, Bäckström & Norring, 2015). It is also known that women with AN experience more anxiety than women without AN (Sternheim, Startup, Schmidt, 2015). In an experimental study that focused on the personality traits that are associated with eating disorders it was found that people who have a

low flexible control, low receptivity and openness are more susceptible to develop an eating disorder such as AN (Hempel et al., 2017). All these different studies are trying to map out the underlying mechanism and constructs that play a role in the onset and maintenance of AN. However, there is still much to learn about the etiology of AN. Therefore, this study aims its focus on a construct known as *Intolerance of uncertainty* (IU).

Intolerance of uncertainty is defined as a disproportionate tendency to respond negatively on a behavioral, cognitive and emotional level in uncertain events and situations (Buhr & Dugas, 2009). The individual believes that a negative event may occur, while the chance of its occurring is small (Carleton, Sharpe, & Asmundson, 2007). The core of IU is described as 'fear for the unknown' (Carleton, 2012). Individuals with an elevated IU have the tendency to interpret ambivalent information as threatening (Butler & Mathews, 1987). A high IU is associated with negative behavioral and emotional responses. Research also shows that IU is associated with various psychological disorders such as obsessive compulsive disorder (OCD) (Lind & Boschen, 2009), generalized anxiety disorder (GAD) (Dugas, Freeston, & Ladouceur, 1997) and depression (Carleton, Mulvogue, Thibodeau, McCabe, Antony & Asmundson, 2012). In a study of Meeten, Dash, Scarlet & Davey (2012) participants were separated in two groups: (1) high IU-group (experimental group) & (2) low IU-group (control group). The high-IU group got an experimental induction of IU in the form of two stories where the situations described are uncertain, and the characters have a high intolerance of uncertainty. The low-IU group got two stories presented that did not induce intolerance. The situations and characters described in the stories that were presented to the low-IU group were not uncertain and were designed to not have any effect on the level of uncertainty of the participants. They concluded that the participants in the high-IU group experienced high levels of sadness and anxiety compared to the participants in the low IU group. This indicates that IU has an effect on the experience of anxiety and sadness.

IU is also linked to eating disorders. Several studies found connections between IU and eating disorders (Renjan, McEvoy, Handley, Fursland & Stomaching, 2016; Sternheim, et al., 2015; Sternheim, Konstantellou, Startup & Schmidt, 2011). Brown et al. (2017) conducted a meta-analysis and systematic review of intolerance of uncertainty in eating disorders. The results show support for IU as an characteristic of AN. The IU was significantly elevated in the AN groups compared to the healthy control groups. Moreover, the meta-analysis shows that there may be neurobiological support for IU in individuals with AN. People with AN that have difficulties coping with uncertainty have alteration in brain activation compared to people that have no difficulties tolerating uncertainty (McFadden, Tregellas, Shott, & Frank, 2014). This differential neural response to uncertainty and threat is mediated by dysfunction in the anterior insula (Grupe & Nitschke, 2013). The anterior insula is contemplated by different studies to play a central role in AN pathology (Kaye, Fudge, & Paulus, 2009; Nunn,

Frampton, Gordon, & Lask, 2008). Furthermore, a review by Kesby, Maguire, Brownlow & Grisham (2017) summarizes the growing literature that examines IU in eating disorders such as AN and the relationship between IU and AN. There is evidence that patients with eating disorders such as AN, restrict their food intake to avoid the uncertainty that is connected to not knowing what the exact consequence will be of the ingested food (Steinglass et al, 2011). In another study by Sternheim et al. (2011) patients also reported that they use eating disorder behaviors (e.g., restriction) as a way to deal with uncertainty and to get a sense of safety. Lastly, there is also evidence that IU has an indirect effect on purging and restraint and that IU is associated with overvaluation of weight, shape, eating and emotional symptoms (Renjan et al., 2011). An explanation is that elevated IU results in more worrying about weight, shape and eating. Worry is an attempt to gain control over an uncontrollable uncertain situation, which leads to purging and restraint in people with an eating disorder, which gives them the illusion of control (Frank et al., 2012). In a study by Sternheim, Fisher, Harrison & Watling (2017) the results show that the eating disorder groups scores higher on IU in comparison to a non-eating disorder group. This confirms the relevance of IU in eating disorders.

The present research

It seems that IU has a positive correlation with the severity of the symptoms and behaviors of AN, but there has not been an experimental study done yet that examines if there is a direct effect of IU on state-eating pathology (purging, restraint, excessive movement to lose calories, etc.) in people with AN. Explorative research on this subject will give us more insight in the effect of IU on state-eating pathology and will help enhancing treatment for individuals with AN.

This study aims to examine if an experimental induction of uncertainty increases state-eating pathology in people with AN. Firstly, people in the high IU group will show an increase in state-eating pathology after experimental induction of IU compared to baseline. Secondly, people in the high IU group will show an increase in IU after the manipulation of IU compared to baseline. Finally, people in the low IU group will not show an increase in state-eating pathology compared to baseline.

Methods

Sample

Thirty Women participated in the current study, of which 29 participants (M = 23.97, SD = 6.54) completed the study. The youngest participant was 18 years and the oldest 45 years of age. The average BMI of the participants was 15.96 (SD = 2.11, Range = 10.5-18.4). All the participants were inpatients at Rintveld Center for Eating disorders, part of mental health institute Altrecht. Patients were all diagnosed with an eating disorder described in the DSM-

IV varying from: AN restrictive, AN purging, eating disorder NOS clinical view ANR & eating disorder NOS clinical view ANP (American Psychiatric Association, 2013).

Recruitment

The patients at Rintveld received an information letter about the study from the therapists. Patients that were interested were called by the researcher to make an appointment. At the appointment the patients received information and gave their consent to recruitment. The study was approved by the institution.

Materials

Visual Analogue Scale (VAS-IU)

The subjective feeling of uncertainty is measured by a psychometric response scale, better known as the visual analogue scale (VAS). Research shows that VAS is a reliable instrument with high internal consistency and validity to measure changes in mood, pain and fatigue (Lee, Hicks & Nino-Murcia, 1991; Reips & Funke, 2008). The participants had to rate how uncertain they felt on a scale from 0-100% with an interval of 5% (0% no uncertainty – 100% extremely uncertain). The VAS-IU consisted of 2 items: (1) 'How uncertain are you at this moment?' and (2) 'How aggravating is this uncertainty?' The VAS-IU measures were taken at different times during the study: (1) at the beginning of the study (baseline) and (2) after the induction of the uncertainty (posttest). This instrument will be used to check if the manipulation was successful.

Intolerance of Uncertainty manipulation (IU-manipulation)

In current study the participants are randomly assigned to two groups: The experimental group is named: High IU group (n = 15) and the control group is named: low IU group (n = 14). The high IU group (experimental group) had to read two stories whereby the character described has high IU, these stories were designed to induce uncertainty (Kelly, 2009). The low IU group (control group) had to read two stories as well, however these stories were not designed to have an effect on the uncertainty levels of the participants. Before and after the stories the participants in both groups will rate their uncertainty by completing the 2 items (VAS-IU). The participants were randomly assigned to prevent other factors than the independent variable to affect the dependent variable. By randomly assigning the participants in two groups, the known and unknown variables that could influence the dependent variable are by chance divided between and within the groups.

Intolerance of uncertainty – 12

The intolerance of uncertainty scale (IUS-12) (Carleton, Norton & Asmundson, 2007) is an instrument that assesses reactions to uncertainty, ambiguous situations and future events and it is based on the IUS (Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). The questionnaire consists of 12 items and is scored on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The IUS has a high internal consistency with Cronbach's a = .87 (Khawaja & Yu, 2010). The 12 items focusing on 2 independent factors: (1) Inhibitory Anxiety (total of 5 items, a = .85) and (2) Prospective Anxiety (total of 7 items, a = .85). The total score of the IUS is used for evaluating a general intolerance of uncertainty (Carleton et al., 2007).

State-eating pathology Questionnaire (SEPQ)

A questionnaire was used to determine if the induction of uncertainty by the experiment had effect on state-eating pathology in patients with AN. The state-eating pathology questionnaire consists of 7 questions that are all focused on the present moment. The questions are formulated by two AN specialized psychiatrists, 2 psychologists and 2 researchers. There is no information about the validity nor reliability. However, it is designed to be of use in a pilot study and gives information about state-eating pathology. In the current study the participants filled out the questionnaire at 2 different moments: (1) At the beginning of the study (baseline) and (2) at the end of the study (post-test). This was done so there would be data to compare and conclude if the IU induction of the experiment has effect on state eating pathology. The choice to formulate questions instead of using a validated questionnaire like the eating disorder examination questionnaire (EDE-Q) as the outcome measure was a deliberate choice. It was important that the questions measured how the participants felt at the moment before and after the IU manipulation. This data could not be collected by the existing validated eating disorders questionnaires like the EDE-Q.

Software and statistical analyses

The statistical data-analyses were conducted with the software program IBM SPSS statistics (version 22.0). Firstly, the descriptive statistics of the participants and diagnoses according to the DSM-V were computed for the low IU and the high IU group.

Thereafter, a multiple regression analyses was used as a manipulation check to compare the level of uncertainty (VAS-IU) that was reported by participants in the 'high-IU' group (n= 15) to the level of uncertainty reported by those in the 'low-IU' group (n =14) after the manipulation using the baseline (pre-test scores) as covariates. The dependent variable were the post-test scores and the independent variables were the pre-test scores (block 1) and the manipulation (block 2). The scores on the 2 questions of the VAS-IU were combined to

one total score, where the total score could vary between 0-200% and were used to compare the total scores between and within the groups.

Thirdly, a one-way analysis of covariance (ANCOVA) was conducted to confirm or deny the findings found by the hierarchical multiple regression. Thenceforth, the VAS-IU scores were analyzed with a Mann-Whitney *U* test because the scores are not evenly distributed (Allen & Bennet, 2010) and the test residual scores for each participants individually were calculated.

Ultimately, the scores on the IUS-12 and the state-eating pathology questionnaire and IUS-12 were analyzed using an independent sample *t* test to examine if the groups scored differently depending if they were assigned to the low-IU or high-IU group. This showed whether IU has an effect on state eating pathology.

Results

Table 1 displays an overview of the average age, participants and DSM-IV classifications for the low IU and high IU group.

Table 1.
Descriptive statistics for the low and high IU group: Average Age, Women and DSM-IV Classification shown for Low and High intolerance of uncertainty groups in Numbers and percentiles.

	Low IU (*n* = 14)	High IU (*n* = 15)
Age M (SD)	25 (8.19)	23 (4.58)
Gender	*n* (%)	*n* (%)
Women	14 (48.3)	15 (51.7)
DSM-IV classification		
AN restrictive	8 (53.3)	7 (46.7)
AN purging	4 (28.6)	8 (53.3)
NOS, ANR	1 (7.1)	0 (0)
NOS, ANP	1 (7.1)	0 (0)

Notes: AN restrictive*:* Anorexia nervosa restrictive (no purging and/or binge eating); AN purging: Anorexia Nervosa purging (with purging and/or binge eating); NOS ANR: Not other specified, Anorexia nervosa restrictive (Not all DSM-IV criteria for ANR are met); NOS ANP: Not other specified, Anorexia Nervosa purging (Not all DSM-IV criteria for ANP are met).

VAS-IU

To estimate the proportion of variance in the post-test scores (dependent variable) that can be accounted for by the manipulation (independent variable) and pre-tests scores (covariates), a multiple regression analysis (MRA) was employed.

On block 1 of the MRA, the pre-test scores accounted for a significant 29.9% of the variance in the post-test scores. R^2 = .299, adjusted R^2 = .27, F (1, 27) = 11.54, p = .002. On block 2, the manipulation was added to the regression equation, and accounted for an additional non-significant 1.1% of the variance in the post-test scores, ΔR^2 = .011, ΔF (1, 26) = .42, p = .524. In combination, the pre-test scores and manipulation explain 31% of the variance in the post-test scores, R^2 = .31, adjusted R^2 = .257, F (2, 26) = 5.85, p = .008 ($p <$ .001). By Cohen's (1988) conventions, a combined effect of this magnitude can be considered ''large'' (f^2 = .45). However, The effect of manipulation on the posttest scores can be considered ''small'' (f^2 = .011). Standardized (*B)* and Unstandardized (β) regression coefficients, and squared semi-partial correlations (sr^2) for each independent variable on each step of the MRA are reported in *table 2*.

Table 2.

Unstandardized (B) and standardized (B) Regression Coefficients, and Squared Semi-Partial Correlations (Sr^2) For Each Predictor Variable On Each Step of a Hierarchical Multiple Regression Predicting the Post-Test Scores on the VAS-IU (n = 29)

Variable	*B*	[95%CI]	β	Sr^2
Block 1				
Pre-test scores	.736	[.292, 1,181]	.547*	.299
Block 2				
Pre-test scores	.696	[.228, 1,165]	.517	.247
Manipulation	-9,646	[-40,320, 21,029]	-.109	.011

Note. CI = confidence interval

** $p < .001$.*

Secondarily, A one-way analysis of covariance was used to compare the post-test scores on the VAS-IU of patients that underwent the manipulation (high IU group) and patients that did not (low IU group). The conducted ANCOVA confirms the results found with the multiple regression analysis. After adjustment for pre-test scores (covariates) of the VAS-IU, there was not a statistically significant difference in post-test scores of the VAS-IU between the groups, F(1, 26) = .418, p = .524, partial $\eta 2$ = .016.

The residual scores (see *table 3*) show that spread of the scores of the participants on the VAS-IU are not evenly distributed and that it would be more fitting to use a non-parametric test to analyze the data (Allen & Bennet, 2010). A Mann-Whitney *U* test was run to determine if there were differences in post-test scores of the VAS-IU between the high IU group (n = 15) and the low IU group (n = 14). The test indicated that the post-test scores of the VAS-IU were not statistically significantly different between the high IU group (*Mdn* = 173, *Mean Rank* = 17.30) and the low IU group (*Mdn* = 145, *Mean Rank* = 12.54), U = 70.50, p = .134, two tailed. Using an exact sampling distribution for U (Dineen & Blakesley, 1973).

Table 3.
Pre-test (Predictor), Post-test (Dependent Variable) and Residual Scores (%) for each Participant (n = 29) on the VAS-IU, Sorted from highest to lowest Residual Change.

Participants	Pre-test	Post-test	Residual change
1.	130,00	30,00	-93,98633
2.	160,00	70,00	-76,07939
3.	185,00	100,00	-64,49028
4.	160,00	100,00	-46,07939
5.	125,00	80,00	-40,30415
6.	100,00	70,00	-31,89327
7.	145,00	105,00	-30,03286
8.	160,00	140,00	-6,07939
9.	180,00	160,00	-,80810
10.	150,00	140,00	1,28496
11.	150,00	140,00	1,28496
12.	90,00	97,00	2,47108
13.	200,00	180,00	4,46319
14.	200,00	180,00	4,46319
15.	188,00	173,00	6,30042
16.	195,00	180,00	8,14537
17.	140,00	140,00	8,64932
18.	190,00	180,00	11,82755
19.	184,00	176,00	12,24616
20.	168,00	165,00	13,02913
21.	160,00	160,00	13,92061
22.	170,00	170,00	16,55625
23.	195,00	195,00	23,14537
24.	170,00	180,00	26,55625
25.	170,00	185,00	31,55625
26.	157,00	176,00	32,12991
27.	175,00	200,00	42,87408
28.	150,00	190,00	51,28496
29.	60,00	150,00	77,56414

Note. Minimum possible score is 0; Maximum possible score is 200.

IUS-12

The independent sample *t* test shows no statistically significant difference *t* (27) = 1.09, *p* = .284, two tailed, 95% [-3.02, 9.88] between the low-IU group (*M* = 39.50, *SD* = 9.05) and the high-IU group (*M* = 42.93, *SD* = 7.87) in the **pre-test** scores of the IUS-12. The levene's test was not significant, thus equal variances can be assumed (*F* = .021, *p* = .886).

The independent sample *t* test also shows no statistically significant difference *t* (27) = 1.52, *p* = .141, two tailed, 95% [-1.77, 11.79] between the low-IU group (*M* = 36.86, *SD* = 7.81) and the high-IU group (*M* = 41.87, *SD* = 9.80) in the **post-test** scores of the IUS-12. The levene's test was not significant, thus equal variances can be assumed (*F* = 2.53, *p* =.123).

State-eating pathology questionnaire

The independent sample *t* test shows no statistically significant difference *t* (27) = -.486, *p* = .631, two tailed, 95% [-10.04, 6.20] between the low-IU group (*M* = 21.86, *SD* = 14.70) and the high-IU group (*M* = 19.93, *SD* = 4.27) in the **pre-test** scores of the SEPQ. The levene's test was not significant, thus equal variances can be assumed (*F* = 1.872, *p* = .183).

The independent sample *t* test also shows no statistically significant difference *t* (27) = 2.81, *p* = .781, two tailed, 95% [-3.00, 3.95] between the low-IU group (*M* =17.86, *SD* = 4.40) and the high-IU group (*M* = 18.33, *SD* = 4.70) in the **post-test** scores of the SEPQ. The levene's test was not significant, thus equal variances can be assumed (*F* = .174, *p* = .680).[1]

Discussion

In the present study the aim was to examine whether inducing intolerance of uncertainty in AN patients would result in an increase in state-eating pathology compared to AN patients whereby the intolerance of uncertainty was not manipulated. The collected data showed that the IU manipulation that was used to manipulate the participants' feelings of uncertainty failed. The multiple regression that was conducted to analyze the IU-VAS scores showed that there is no significant difference in the reported IU between the low-IU group (control group) and the high-IU group (manipulation group). This means that the manipulation did not have an effect above and beyond the effects of the pre-test scores (baseline) of the participants on the VAS-IU. This finding was confirmed by the conducted ANCOVA and by the non-parametric test (Mann-Whitney *U* test). There is no clear change between the two groups, thus

[1] Despite the failed manipulation and the failure to meet the assumptions for the multiple regression, the statistical tests were conducted as if the manipulation was significant and as if the assumptions were all met. This was done for educational purposes.

the manipulation did not have the desired effect. Hereby, all the formulated expectations are rejected because all the hypotheses were dependent on the manipulation.

Even though the manipulation was not successful, we analyzed the scores of the IUS-12 (Carleton, Norton & Asmundson, 2007) and the SEPQ with independent sample *t* tests. The tests showed that there is no clear difference between the high IU group and the low IU group in the pre-test and the post-test scores. The consideration to examine and compare the scores of the IUS-12 (Carleton, Norton & Asmundson, 2007) and the state-eating pathology questionnaire between the two groups despite the failed manipulation check is possible. However, the results could not be used because the possible differences between the groups are not the consequence of the manipulation and could not be explained by the variable IU.

Why the manipulation was not successful is not easily explained. First of all, the current study is a pilot study so it is the first study that has been conducted to examine the direct effect of intolerance of uncertainty on state eating pathology in patients with AN. Therefore, there is no frame of reference and it makes it difficult to compare it to similar studies to find out why the manipulation failed. However, there are several possible explanations for the failed manipulation.

The procedure and IU manipulation used in this study are almost identical to the study of Meeten et al. (2012), of which the IU manipulation originally was designed by Kelly (2009). In the study of Meeten et al (2012) the IU manipulation was successful whereas the manipulation in current study failed despite the similarities in procedure. The difference between the current study and the study of Meeten et al. (2012) is that they used healthy undergraduate and postgraduate students as participants and in the current study the participants were inpatients in a psychiatric institute diagnosed with an eating disorder. This could be an important distinction between the study of Meeten et al. (2012) and current study, because individuals suffering from anorexia nervosa could have impaired cognitive capacities due the lack of nutrients and vitamins in the body in comparison to the healthy students that participated in the study of Meeten et al. (2012). Furthermore, there are most likely more differences between the samples (self-image, motivation, mood, etc.) in current study and in the study of Meeten et al. (2012) that possibly could explain the difference in manipulation effect. In different studies (Brown et al., 2017; Sternheim et al. 2017) results show that people with AN report higher feelings of uncertainty than people without AN. In current study the results show that patients reported a high feeling of uncertainty at the beginning of the experiment pre-test measurement on the VAS-IU (see *table 3*). Therefore, it is possible that in current study there may be a ceiling effect, thus the VAS-IUS scores could not increase in the post-test because in the pre-test the scores were already high. A possible solution for this effect is to let the participant get adjusted to the setting by letting them do another task before starting with the VAS-IU baseline measurement. This information makes it plausible that the

differences between the sample groups could explain why the IU manipulation was not successful in current study in contrast to the study of Meeten et al. (2012).

Another difference between the current study and the study of Meeten et al (2012) is that in current study the participants were all women, whereas the participants in the study of Meeten et al (2012) consisted of male participants as well. Whether gender actually contributed to the failure of manipulation is to this point unknown. There is no research done yet that examines if there is a sex difference with respect to IU.

A remarkable outcome is that eighteen of the in total 29 participants reported a higher feeling of uncertainty on the VAS-IU before the experimental induction of uncertainty than after the manipulation. A possible explanation could be that the participants had high feelings of uncertainty regarding the manipulation and when the experiment was over the feeling of uncertainty decreased and they felt like they succeeded in something. This could possibly explain the decrease in the reported feelings of uncertainty after the manipulation. Another possible explanation for the failed manipulation check is that eating disorder patients have the tendency to be perceived perfect (Bastiani et al., 1995). This possibly could have played a role on the outcome of the study. Whenever individuals want to be perceived perfect they give socially desirable answers. The visual analogue scale that was used in the current study to measure the subjective feeling of intolerance of uncertainty is susceptible for socially desirable answers (Reips & Funk, 2008). This information in combination with the tendency of eating disorder patients to be perceived perfect, could have possibly contributed to the failure of the manipulation.

Lastly, this study had a small and specific sample. Because of this, any extreme score or outlier could have an influence on the results in a way that there would or would not be a statistical significant difference between the two groups (Allen & Bennet, 2010). The residual scores showed that the reported feelings of uncertainty on the VAS-IU were not evenly distributed and this could have been critical in not finding any differences between the groups. Moreover, without the outliers (extreme scores), the manipulation could have been possibly statistically significant. However, because of the sample size and the learning objectives of this thesis it was not responsible and legitimate to delete or transform the data. Instead of dealing with the fact that the data was not evenly distributed it was more fitting to use a non-parametric test to analyze the data. The non-parametric test: Mann-Whitney *U* was conducted and also showed that the manipulation did not have the desired effect. The small sample size and the fact that the scores were not evenly distributed are possible factors that could explain the results.

Strengths and limitations

This present study has strengths and limitations that are important to elaborate on. First of all the participants were all inpatients at Rintveld Center for eating disorders. This could be perceived as a limitation because not all individuals with AN are admitted but remain outpatient, this means that if the manipulation was successful and the results were interpretable, the results could not be generalized. This implicates that the external validity of the results are low in current study. Furthermore, the sample consisted of exclusively women; this means that the results could only be applied to women, not men. A variation in participants and a representative sample will increase the external validity of the study (Green & Glasgow, 2006). On the other hand the specificity of the participants could be perceived as a strength because the sample is specific and possible positive outcomes could directly be implicated in a clinical setting. Another limitation is the small sample size, a larger sample size may result in a higher reliability (Charter, 1999). One of the strengths of this study is that it was a pilot study. This is the first study ever that examines if an experimental induction of uncertainty increases state-eating pathology in people with AN in the Netherlands. The study was explorative and it could motivate and inspire other scientists to do more research on IU and AN.

Conclusion & Follow-up research

In the last decade AN is getting more attention. Researchers are increasingly focused on the underlying traits and mechanisms that are associated with the onset, development and persistence of AN (e.g., Meeten et al., 2012; Sternheim, Startup & Schmidt, 2015). Earlier studies showed that IU is linked to different disorders (depression, OCD & GAD) and it could be probably an important underlying mechanism in eating disorders (Lind & Boschen, 2009; Dugas, Freeston, & Ladouceur, 1997; Carleton, Mulvogue, Thibodeau, McCabe, Antony & Asmundson, 2012). If it turns out that IU plays a major role in the onset and persistence of AN, this knowledge might improve treatment, prevent vulnerable people from developing AN, and in the long run save lives. In present study the experimental manipulation of IU did not have the expected effect. Therefore, it is not possible to make a statement about the effect of IU on the state-eating pathology in patients with AN.

It is recommendable that follow-up research keeps examining the construct IU and its relationship regarding state-eating pathology in patients with AN. It is advisable to use a larger and a more diverse sample and find or develop other methods to induce intolerance of uncertainty in participants. Furthermore it would be recommended to let the participants get used to the setting before they start with the actual study. This will possibly prevent participants to experience and report a high feeling of uncertainty at the beginning of the experiment.

Literature

Allen, P. and Bennett, K. 2010. *PASW statistics by SPSS: A practical guide: Version 18.0,* Melbourne: Cengage Learning.

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: American Psychiatric Publishing. doi:10.1007/springerreference_179660

Arcelus, J., Mitchell, A. J., Wales, J. & Nielsen, S. Mortality rates in patients with anorexia nervosa and other eating disorders (2011). A meta-analysis of 36 studies. *Archives Of General Psychiatry, 68,* 724–731. doi:10.1001/archgenpsychiatry.2011.74

Bastiani, A. M., Rao, R., Weltzin, T., & Kaye, W. H. (1995). Perfectionism in anorexia nervosa. *International Journal of Eating Disorders, 17,* 147-152. doi:10.1002/1098-108X(199503)17:2<147::AID-EAT2260170207>3.0.CO;2-X

Buhr K, Dugas MJ. (2009). The role of fear of anxiety and intolerance of uncertainty in worry: an experimental manipulation. *Behaviour Research and Therapy, 47,* 215–23. https://doi.org/10.1016/j.brat.2008.12.004.

Bulik, C. M., Reba, L., Siega-Riz, A. M., & Reichborn-Kjennerud, T. (2005). Anorexia nervosa: Definition, epidemiology, and cycle of risk. *International Journal of Eating Disorders, 37,* 2–9. doi:10.1002/eat.20107

Butler, G. and Mathews, A. (1987). Anticipatory anxiety and risk perceptions. *Cognitive Therapy and Research, 11,* 551–565. doi:10.1007/bf01183858

Carleton, R. N., Mulvogue, M. K., Thibodeau, M. A., McCabe, R. E., Antony, M. M., Asmundson, G. J. (2012). Increasingly certain about uncertainty: intolerance of uncertainty across anxiety and depression. *Journal of Anxiety Disorders, 26,* 468–479. doi:10.1016/j.janxdis.2012.01.011

Carleton R. N., Sharpe, D., Asmundson, G, J. (2007). Anxiety sensitivity and intolerance of uncertainty: requisites of the fundamental fears? *Behaviour Research Therapy, 45,* 2307-2316. doi:10.1016/j.brat.2007.04.006

Charter, R.A. (1999). Sample size requirements for precise estimates of reliability, generalizability, and validity coefficients. *Journal of Clinical and Experimental Neuropsychology, 21,* 559-66. doi:10.1016/j.brat.2007.04.006

Cohen, J. (1988). *Statistical power analysis for the behavioral science* (2nd ed.). Hillsdale, NJ: Erlbaum. doi:10.2307/2290095

Dinneen, L. C., & Blakesley, B. C. (1973). Algorithm AS 62: A Generator for the Sampling Distribution of the Mann- Whitney U Statistic. *Applied Statistics, 22,* 269. doi:10.2307/2346934

Dugas, M. J., Freeston, M. H., & Ladouceur, R. (1997). Intolerance of uncertainty and problem orientation in worry. *Cognitive Therapy and Research, 21*, 593–606. doi:10.1023/a:1021890322153

Fairburn, C. G., & Harrison, P. J. (2003). Eating Disorders. *The Lancet, 361*, 407-416. doi:10.1016/s0140-6736(03)12378-1

Freeston M.H., Rheaume J., Letarte H., Dugas M.J., Ladouceur R. (1994). Why do people worry? *Personality & Individual Differences, 17*, 791–802. doi:10.1016/0191-8869(94)90048-5

Frank, G. K., Roblek, T. , Shott, M. E., Jappe, L. M., Rollin, M. D., Hagman, J. O. and Pryor, T. (2012), Heightened fear of uncertainty in anorexia and bulimia nervosa. *International. Journal of Eating Disorders, 45*, 227-232. doi:10.1002/eat.20929

Green, L., & Glasgow, R. (2006). Evaluating the relevance, generalization, and applicability of research: Issues in external validation and translation methodology. *Evaluation & the Health Professions, 29*, 126-153. doi:10.1177/0163278705284445

Grupe, D. W., & Nitschke, J. B. (2013). Uncertainty and anticipation in anxiety: An integrated neurobiological and psychological perspective. *Nature Reviews Neuroscience, 14*, 488–501. doi:10.1038/nrn3524

Hempel, R., Vanderbleek, E., & Lynch, T. (2018). Radically Open DBT: Targeting emotional loneliness in Anorexia Nervosa Eating Disorders: *The Journal of Treatment and Prevention, 26*, 92-104. doi:10.1080/10640266.2018.1418268

Hoek, H, W., Van Hoeken, D. (2003). Review of the prevalence and incidence of eating disorders. *International Journal of Eating Disorders, 34*, 383-396. doi:10.1002/eat.10222

Hoek, H, W., Vandereycken, W. (2008). Eating disorders; 25 years of research and treatment. *Tijdschrift Psychiatrie, 50*, 85-89.

Kaye, W. H., Fudge, J. L., & Paulus, M. (2009). New insights into symptoms and neurocircuit function of anorexia nervosa. *Nature Reviews Neuroscience, 10*, 573–584. doi:10.1038/nrn2682

Kelly, O. (2009). The escalation of non-pathological worry into generalised anxiety disorder: *An investigation of two influential models*. Doctoral dissertation, University of Western Australia. doi:10.4135/9781446289105.n1

Kesby, A., Maguire, S., Brownlow, R., and Grisham, J. R. (2017). Intolerance of uncertainty in eating disorders: an update on the field. *Clin. Psychol. Rev. 56*, 94–105. doi: 10.1016/j.cpr.2017.07.002

Khawaja, N. G. and Yu, L. N. (2010), A comparison of the 27-item and 12-item intolerance of uncertainty scales. *Clinical Psychologist, 14*, 97-106. doi:10.1080/13284207.2010.502542

Lee, K. A., Hicks, G., & Nino-Murcia, G. (1991). Validity and reliability of a scale to assess fatigue. *Psychiatry Research, 36*, 291-298. doi:10.1016/0165-1781(91)90027-m

Lind, C., Boschen, M, J. (2009). Intolerance of uncertainty mediates the relationship between responsibility beliefs and compulsive checking. *Journal of Anxiety Disorders, 23*, 1047–1052. doi:10.1016/j.janxdis.2009.07.005

Levallius, J., Clinton, D., Bäckström, M., & Norring, C. (2015). Who do you think you are? Personality in eating disorder patients. *Journal of Eating Disorders, 3*, 3. doi:10.1186/s40337-015-0042-6

McFadden, K. L., Tregellas, J. R., Shott, M. E., & Frank, G. K. (2014). Reduced salience and default mode network activity in women with anorexia nervosa. *Journal of Psychiatry & Neuroscience, 39*, 178–188. doi:10.1503/jpn.130046

Meeten, F., Dash, S. R., Scarlet, A. L., & Davey, G. C. (2012). Investigating the effect of intolerance of uncertainty on catastrophic worrying and mood. *Behavior Research and Therapy, 50*, 690–698. doi:10.1016/j.brat.2012.08.003

Nunn, K., Frampton, I., Gordon, I., & Lask, B. (2008). The fault is not in her parents but in her insula—a neurobiological hypothesis of anorexia nervosa. *European Eating Disorders Review, 16*, 355–360. doi:10.1002/erv.890

Papadopoulos, F. C., Ekbom, A., Brandt, L., Ekselius, L. (2009). Excess mortality, causes of death and prognostic factors in anorexia nervosa. *The British Journal of Psychiatry, 194*, 10-17. doi:10.1192/bjp.bp.108.054742

Pike, K. M., Hoek, H. W., Dunne, P. E. (2014). Cultural trends and eating disorders. *Current Opinion in Psychiatry, 27*, 436–442. doi:10.1097/yco.0000000000000100

Renjan, V., McEvoy, P. M., Handley, A. K., & Fursland, A. (2016). Stomaching uncertainty: Relationships among intolerance of uncertainty, eating disorder pathology, and comorbid emotional symptoms. *Journal of Anxiety Disorders, 41*, 88–95. doi:10.1016/j.janxdis.2016.03.008

Reips, U. D., & Funke, F. (2008). Interval-level measurement with visual analogue scales in Internet-based research: VAS Generator. *Behavior Research Methods, 40*, 699–704. doi:10.3758/brm.40.3.699

Smink, F., Van Hoeken, D., Donker, G., Susser, E., Oldehinkel, A., & Hoek, H. (2016). Three decades of eating disorders in Dutch primary care: Decreasing incidence of bulimia nervosa but not of anorexia nervosa. *Psychological Medicine, 46*, 1189-1196. doi:10.1017/s003329171500272x

Steinglass, J. E., Sysko, R., Glasofer, D., Albano, A. M., Simpson, H. B., & Walsh, B. T. (2011). Rationale for the application of exposure and response prevention to the treatment of anorexia nervosa. *The International Journal of Eating Disorders, 44*, 134–141. doi:10.1002/eat.20784

Sternheim, L., & Harrison, A. (2018). The acceptability, feasibility and possible benefits of a group-based intervention targeting intolerance of uncertainty in adolescent inpatients with anorexia nervosa. *Cogent Psychology*, *5*. doi:10.1080/23311908.2018.1441594

Sternheim, L., Konstantellou, A., Startup, H., & Schmidt, U. (2011). What does uncertainty mean to women with anorexia nervosa? An interpretative phenomenological analysis. *European Eating Disorders Review*, *19*, 12–24. doi:10.1002/erv.1029

Sternheim, L., Startup, H., & Schmidt, U. (2015). Anxiety-related processes in anorexia nervosa and their relation to eating disorder pathology, depression and anxiety. *Advances in Eating Disorders*, *3*, 13–9. doi:10.1002/erv.1029

Zipfel, S., Giel, K. E., Bulik, C. M., Hay, P., & Schmidt, U. (2015) Anorexia nervosa: aetiology, assessment, and treatment. *Lancet Psychiatry*, *2*, 1099–1111. doi:10.1016/s2215-0366(15)00356-9