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Decision making in individuals with anorexia nervosa and individuals with the somatic symptom disorder and the moderating effect of expressive suppression

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Abstract

Objective: The purpose of the current study was to examine if there was impaired decision making in patients with anorexia nervosa (AN) and patients with the somatic symptom disorder (SSD). Thereby, the moderating role of expressive suppression on this relation was investigated.

Method: Twelve patients with AN, nineteen patients with SSD and fourteen healthy controls participated in this study. Decision making was measured by the performance on the Iowa Gambling Task (IGT) and expressive suppression was measured by the Emotion Regulation Questionnaire (ERQ). Additionally, relevant characteristics were assessed (e.g. depressive symptoms).

Results: The findings indicated that SSD patients performed poorly on the IGT, but no significant differences were found between the groups. Healthy controls show a slightly better learning effect on the IGT compared to both patient groups, but this was not significant. No effect of expressive suppression on decision making was found in the three groups.

Conclusion: Our results are not in line with previous research that found a link between AN and impaired decision making, what could be due to confounding factors (e.g. AN subtype). This is the first time decision making of SSD patients is investigated and they show a tendency of a decreasing IGT performance over time. However, there should be more research to draw any conclusions about their decision making of SSD patients. A limitation of the current study is the small sample size, causing power problems. A strength is including different patient groups in the same study.

Introduction

Anorexia nervosa (AN) and the somatic symptom disorder (SSD) are severe psychiatric disorders, which are both characterized by a physical component and emotional dysfunction. Remarkably, hardly any studies have been done comparing these disorders. For both disorders to be diagnosed, a somatic component is required. AN is diagnosed when there is a significant low body weight (American Psychiatric Association [APA], 2013). In addition, a restrictive eating pattern and excessive concerns regarding body and weight are diagnostic criteria (APA, 2013). SSD is diagnosed when there are one or more physical complaints that cause suffering and disrupt everyday life significantly (APA, 2013). The severity of both disorders is high. AN affects mostly young women and only 50% of patients recovers fully (Keel & Brown, 2010). This means that 50% of AN patients experiences one or more symptoms throughout the rest of their lives, which decreases their quality of life (e.g. by worrying about their weight or restricting themselves in eating). Patients with SSD experience a low quality of life as well. This is characterized by a high frequency of absence rates at work and limitations in daily activities (Erkic et al., 2018). To improve the quality of life of patients with these disorders, is it important to gain more knowledge about possible underlying and maintaining factors. Knowing which factors need to be focused on in therapy can contribute to the improvement of treatments.

A factor that is discussed in literature as underlying element in both disorders, is emotional dysfunction. It is argued that both disorders result from difficulties with regulating negative affect. Previous research shows that the tendency to suppress the expression of their emotions is high in individuals with AN (Danner, Sternheim & Evers, 2014) and SSD (Erkic et al., 2018). However, this expressive suppression is seen as a maladaptive emotion regulation strategy, because it suppresses the expression of the emotion rather than the emotion itself (Gross & Leverson, 1993). This would mean that the negative emotion stays present, although the expression is absent. Engel and colleagues (2013) found that the presence of negative affect is linked to eating disorder behavior. Increased negative affect seems to be a predictive factor for anorectic behaviors like exercising and drinking fluids to curb one’s appetite, which subsequently reduce negative affect. Engel and colleagues (2013) speculate that this reduction is due to the positive view that AN patients have on these behaviors, because it could result in weight reduction. From this point of view, AN could be seen as a defense mechanism against negative affect. It seems SDD is also linked to negative affect. Waller & Scheidt (2006) describe the theory that negative emotions stay unconscious in somatoform disorders, due to the somatization of these feelings. This suggests that dealing with negative affect seems to be problematic for individuals with SSD, just as for individuals with AN.

This kind of emotional dysfunction, is known to be related to cognitive problems. One cognitive domain that is suggested to be influenced by the presence of negative affect, is decision making. Decision making is a process of forming preferences, selecting and executing actions and evaluating outcomes (Ernst & Paules, 2005). This makes decision making important for controlling behavior and acting in a way that benefits on the long term. Negative affect seems to have a disadvantageous effect on decision making. Evidence for this is provided by De Vries and colleagues (2008), who found that a negative affective state is associated with a lower performance on a decision making task, compared to a positive affective state. This is confirmed by Bagneux and colleagues (2013), who found that a negative mood, like anxiety, was associated with impaired decision making. When we look at decision making behavior of individuals with AN, the majority of the studies show a link between AN symptoms and impaired decision making behavior (Garrido & Subirá, 2013; Brogan, Hevey & Pignatti, 2010; Tchanturia et al., 2007; Cavedini et al., 2004) and only a few studies do not support these findings (Bosonac et al., 2007; Guillaume et al., 2010). Guillaume and colleagues (2015) included 35 studies in a meta-analysis on eating disorders and decision making, and concluded that individuals with AN perform worse on a decision task compared to healthy controls (HC) and recovered women from AN. They argue that individuals with AN tend to make decisions based on short term gratification, instead of long term goals. For example, AN patients who are in therapy, still choose to decrease food intake sometimes, while their long term goal is to be healthy and to recover from AN. Surprisingly, however, no research has yet been conducted on decision making behavior in relation to SSD. This is unexpected, because there are indications for less adaptive decision making behavior in SSD patients. For example, individuals with SSD tend to deny that psychosocial factors may play a role in their suffering and decide to stay in the healthcare system and keep visiting doctors (Waller & Scheidt, 2006), even if it is clear that the somatic complaints cannot be explained medically. This could be an outcome of impaired decision making, which would be interesting to investigate.

Decision making is mostly examined by the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994). This task simulates real-life decision situations in conditions of uncertainty, where rewards and punishments are involved. Bechera & Damasio (2005) state that when circumstances are uncertain and someone does not know what the outcome of the decision will be, the decision is made based on one's gut feeling. This gut feeling is guided by physiological signals (e.g. skin conductance), which are named somatic markers (Damasio, 1996). These somatic markers are sent when a risky decision could be made, which influences the decision making progress. Bechara & Damasio (2005) explain that without these somatic markers, one cannot estimate the adverse consequences of the decision. This is why the decision in that case will be mainly focused on a short term reward. Making decisions based on short term rewards, is known to be very common in individuals with AN (Danner et al., 2012), which makes it interesting to look at the functioning of the somatic markers in AN. Tchanturia and colleagues (2007) investigated this, by measuring the amount of somatic markers in an AN group and an HC group. They monitored skin conductance responses of individuals with AN, while performing the IGT. They found that participants with AN have significantly lower skin conductance responses when they are making decisions, despite of the degree of risk. In other words, there are less somatic markers activated by making decisions under uncertainty. Tchanturia and colleagues (2007) hypothesized that this could be explained physically. The lower somatic response could be a result of the starvation that is associated with AN. If there would be evidence for a relation between SSD and impaired decision making, it would be interesting to see if there is also a link with SSD and lower somatic marker activation. The somatic pain that is linked to SSD (APA, 2013), could interfere with the somatic markers. However, this is just a hypothesis.

Another hypothesis is that these somatic markers are disturbed by negative affect. Heilman and colleagues (2010) suggest that a negative mood alters decision making under uncertainty, by increasing physiological noise that interferes with the somatic markers. Based on this hypothesis, decision making in an uncertain situation would be even more difficult when one is not able to regulate the negative emotions that are activated by this situation. When one uses expressive suppression in such situation, there are two different ways how this could interfere with decision making. Heilman and colleagues (2010) describe an emotional and cognitive route by which suppression might have an effect on decision making. The emotional route is based on the idea that expressive suppression does not reduce the negative affect, which disturbs the somatic markers. The cognitive route is based on the ego depletion model, which suggests that emotion regulation depletes one's mental resources (Baumeister, Bratslavsky, Muraven & Tice, 1998). Gross (2002) explains how expressive suppression requires self-monitoring and self-corrective action. These actions decline the mental resources that are needed for other mental processes, such as decision making.

This study aims to examine decision making in patients with AN and patients with SSD and to explore the moderating role of expressive suppression. Our first hypothesis is that both patient groups show more decision making impairment than HC. Hereby we expect that HC will show a learning effect on a decision making task, in contrast to both patient groups. This would be in line with previous research about decision making in individuals with AN (Garrido & Subirá, 2013; Brogan, Hevey & Pignatti, 2010; Tchanturia et al., 2007; Cavedini et al., 2004) and is, to our knowledge, the first time that this will be investigated in individuals with SSD. Our second hypothesis is that expressive suppression moderates the possible relation between AN or SSD and impaired decision making. So we expect to find a link between AN or SSD and impaired decision making, which will be stronger in those with a higher use of expressive expression (Heilman et al., 2010).

Method

Participants

A total of 46 individuals participated in the present study. One AN patients was excluded from all analyses due to familiarity with the IGT task, resulting in the inclusion of 45 participants in the analyses (AN = 12, SSD = 19, HC = 14). Age ranged from 20 to 63, with a mean age of 36.2 (*SD* = 13.8). The years of education ranged from 9 to 24, with a mean of 15.8 (*SD* = 3.3).

The individuals with AN were recruited in Rintveld Eating Disorder, a specialized mental care institution for eating disorders. The average age of onset was 15.9 (*SD* = 5.6). The individuals with SSD were recruited at Eikenboom, a specialized mental care institution for psychosomatic disorders. The average age of onset was 23 (*SD* = 10.9). Both AN and SSD patients were diagnosed by a psychiatrist or specialized psychologist, according to the DSM-5 criteria. The healthy controls were recruited in the social network of the investigators involved in this study.

The exclusion criteria that were used were the presence of neurological problems, mental disability, substance abuse, severe suicidality and psychosis. This study was approved by the Medical Ethical Committee (METC) of University Medical Center Utrecht and the institutional review board of Altrecht Mental Health Institute.

Measurements

Screening. The MINI is a structured diagnostic interview to screen the DSM-IV and ICD-10 psychiatric disorders (Sheehan et al., 1998). The MINI has good reliability and validity (Hergueta, Baker & Dunbar, 1998). A short version of the MINI was used to screen the healthy controls. This took approximately 15 minutes and was conducted by a master student clinical psychology or research-assistant.

Decision making. A computerized version of the Iowa Gambling Task (IGT) was used to measure the decision making strategy by factoring uncertainty, rewards and penalties (Bechara, Damasio, Tranel & Damasio, 1997). Participants were instructed to choose 100 cards from four decks of cards, and gain as much as possible before the completion of the task. They started with a loan of €2000,-. Turning a card could have an immediate reward (€100,- in decks A & B and €50 in decks C & D) or a penalty (a large one in decks A & B, e.g. -€350, and a small one in decks C & D, e.g. -€50). When a deck was selected, numbers representing rewards and penalties were presented on the screen. The penalties occurred unpredictably and the participants had no way of knowing when they would occur. When the participant played mostly from the disadvantageous decks (A & B, which the large rewards and large penalties), they ended up with an overall loss. When they played the advantageous decks more often (C & D, with the small rewards and small penalties), they would be rewarded with an overall gain. The participants have to learn to choose the advantageous decks to get a profit in the long run, instead of choosing the larger immediate reward of the disadvantageous decks.

The IGT consists of 100 trials, which are divided into five blocks of 20 trials. The net block scores are calculated by subtracting the number of cards chosen from the advantageous decks versus disadvantageous decks [(C + D) - (A + B)]. The total net score is calculated in the same way as the block net scores. The learning effect is measured by the performance improvement over time (across the five blocks). Decision making impairment is characterized by a lack of improvement.

Emotion Regulation Strategies. The Dutch version of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), was used to measure expressive suppression (Cronbach's α=.75). This questionnaire exists of 10 items: 4 items about emotion suppression (e.g. "I keep my emotions to myself") and 6 items about cognitive reappraisal (e.g. "When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm"). The ERQ has good reliability and validity (Gross & John, 2003). In the current study used only the 4 items about emotion suppression.

Additional measures. The degree of the presence of different dimensions of psychopathology was determined with the Brief Symptom Inventory (BSI; Derogatis, 1975; Cronbach's α=.98). The BSI consists of 53 items and is based on nine different dimensions of psychiatric symptoms (somatic complaints, cognitive problems, interpersonal sensitivity, depressed mood, anxiety, hostility, phobic anxiety, paranoid thoughts and psychoticism). Each item is answered on a scale with values from 1 (not at all) to 4 (very much), where a higher score indicates more severe symptoms. The BSI has good reliability and validity (De Beurs & Zitman, 2005).

Procedure

All participants were informed about the procedure. When they were willing to participate, an appointment was made. Healthy control participants were first screened with a short version of the MINI, to ensure that they did not suffer from current or lifetime psychiatric disorders. All patients and healthy participants who passed screening gave written informed consent. After that, they were sat down behind a computer in a quiet room and they started with filling in several questionnaires. The order of the different measurements was as follows: demographics, IGT, BSI and ERQ. Finally, participants were debriefed and thanked for participation. The participants received no reward for their participation. The total experiment lasted 45 minutes for patients, and 60 minutes for healthy controls, due to the screening beforehand.

Statistical analyses

All statistical analyses were conducted in IBM SPSS Statistics 22. Demographic variables and clinical characteristics of the three groups (e.g. age, education level, age of onset, IGT total score, suppression) were compared using analysis of variance (ANOVA). The IGT total score and expressive suppression were checked for outliers (>3 SDs above the mean).

The assumption of normality was assessed the scores on each deck of the IGT, the IGT total score and expressive suppression, using the Shapiro-Wilk test. These statistics indicated that the assumption of normality was supported for all variables, with exception of deck two. We decided to use no data transformations. Firstly because visual inspection showed that deck two was distributed close to normal, but mainly because previous research showed that an F-test remains robust under non-normal distributions (Blanca, Alarcon, Arnau, Bono, & Bendayan, 2017). Levene’s test statistic was used to test the assumption of homogeneity of variance, which was not violated. When Mauchly's test showed that sphericity could not be assumed ($p < .05$), Huynh-Feldt corrections were used.

The first hypothesis was tested by comparing the learning effect on the IGT. This was examined using a 3 (groups: AN, SSD, HC) x 5 (five blocks) repeated measures ANOVA. The second hypothesis was also tested using repeated measures ANOVA, by looking at the interaction effect between the different groups (AN, SSD and HC), the IGT scores (five blocks) and expressive suppression. The different groups were entered as the independent variable, the five IGT blocks as the dependent variable and expressive suppression as moderator. For all comparisons, significance was set at $p < .05$. When analyses showed significant differences between the groups, Bonferroni post-hoc comparisons were performed. The Bonferroni post-hoc test was used to reduce the chance of Type 1 errors (Field, 2013), by adjusting the significance level for the fact that multiple comparisons are being made.

Results

There was missing data on all BSI scores from one SSD patient and one HC participant. One SSD patient was excluded from analyses regarding the age of onset, due to an incorrect response.

Sample Characteristics

Means and standards deviations of the demographic and clinical characteristics are listed in Table 1. One-way ANOVAs and post hoc tests showed that SSD patients were older than AN patients and HC. As expected, AN patients had a lower BMI than the SSD patients and HC participants. Age and BMI are not integrated in the repeated measure ANOVA as controlling factors, due to power problems. No group differences were found regarding years of education. Age of onset symptoms was almost significantly different between the two patient groups, where SSD patients experienced symptoms on average eight years earlier than AN patients. As expected, both patient groups scored higher on all psychiatric symptoms of the BSI compared to the HC, with exception to the subscales hostility, phobic anxiety and paranoid thoughts. There was no significant difference found between AN patients and HC on these three subscales.

Table 1
Mean (SD) scores on demographic and clinical characteristics

	AN, *n* = 12	SSD, *n* = 19	HC, *n* = 14	*F*	*p*
Age	27.2 (8.3)	45.2 (13.3)[a]	31.6 (11.3)	10.45	<.001
Gender *n* female (%)	12 (100%)	14 (73.7%)	7 (50%)	-	-
BMI	16.9 (2.6)[b]	27.5 (7.5)	23.6 (2.3)	15.17	<.001
Years of education	14.8 (2.6)	16.3 (4.3)	16.0 (2.4)	.74	.485
Age onset illness (years)*	15.9 (5.9)	23.0 (10.9)	-	4.21	.050
BSI-somatic**	2.1 (1.0)[c]	2.7 (1.0)[c]	1.1 (0.1)	14.04	<.001
BSI-cognitive**	2.7 (0.9)[c]	2.8 (1.0)[c]	1.4 (0.4)	11.41	<.001
BSI-interpersonal**	2.9 (1.3)[c]	2.8 (1.0)[c]	1.4 (0.4)	9.55	<.001
BSI-depression**	3.3 (1.2)[c]	3.1 (1.0)[c]	1.3 (0.3)	18.86	<.001
BSI-anxiety**	2.5 (1.0)[c]	2.9 (1.1)[c]	1.2 (0.3)	13.26	<.001
BSI-hostility**	1.8 (0.8)	1.7 (0.6)[d]	1.2 (0.1)	3.85	.030
BSI-phobic**	2.0 (1.1)	2.5 (1.2)[d]	1.2 (0.2)	7.21	.002
BSI-paranoid**	1.8 (0.9)	2.2 (1.0)[d]	1.2 (0.3)	5.35	<.001
BSI-psychotic**	2.3 (0.8)[c]	2.4 (0.8)[c]	1.2 (0.3)	11.16	<.001
BSI-total**	2.4 (0.8)[c]	2.6 (0.8)[c]	1.2 (0.2)	16.28	<.001
Emotion suppression	4.6 (0.8)[c]	4.4 (0.9)[c]	2.7 (1.0)	18.74	<.001
IGT total score	-3.0 (19.3)	-19.6 (33.0)	-22.1 (30.9)	1.63	.208

Note. AN = Anorexia Nervosa; SSD = Somatic Symptom Disorder; HC = Healthy controls.
[a]SSD differs from other groups.
[b]AN differs from other groups.
[c]Patient groups differ from the HC.
[d]SSD differs from the HC.
*SSD, *n* = 18.
**SSD, *n* = 18; HC, *n* = 13.

IGT performance

Figure 1 shows the IGT performance of the three groups. No significant effect was obtained for Block, F (4, 168) = 1.04, p = 0.38, meaning that there was no learning effect on the IGT across groups. A significant main effect was not found for Group, F (2, 42) = 1.63, p = 0.21. A significant interaction between the Group and Block was reported, F (8, 168) = 2.26, p = 0.03.

To examine the interaction effect, pairwise comparisons were conducted. They showed that the net block scores within the AN group did not differ from each other, just as in the SSD group. The HC net score on block five was significant higher than their net scores on block two (p =.01) and block three (p = .02). This indicates that the HC group had a slightly better learning effect than the patient groups, although the overall learning effects of the groups were not significant different. The comparisons of the separate net block scores between groups showed that the net score of the AN group was significantly higher than the HC group in block three (p = 0.02), and higher than the SSD group in block four (p = 0.04).

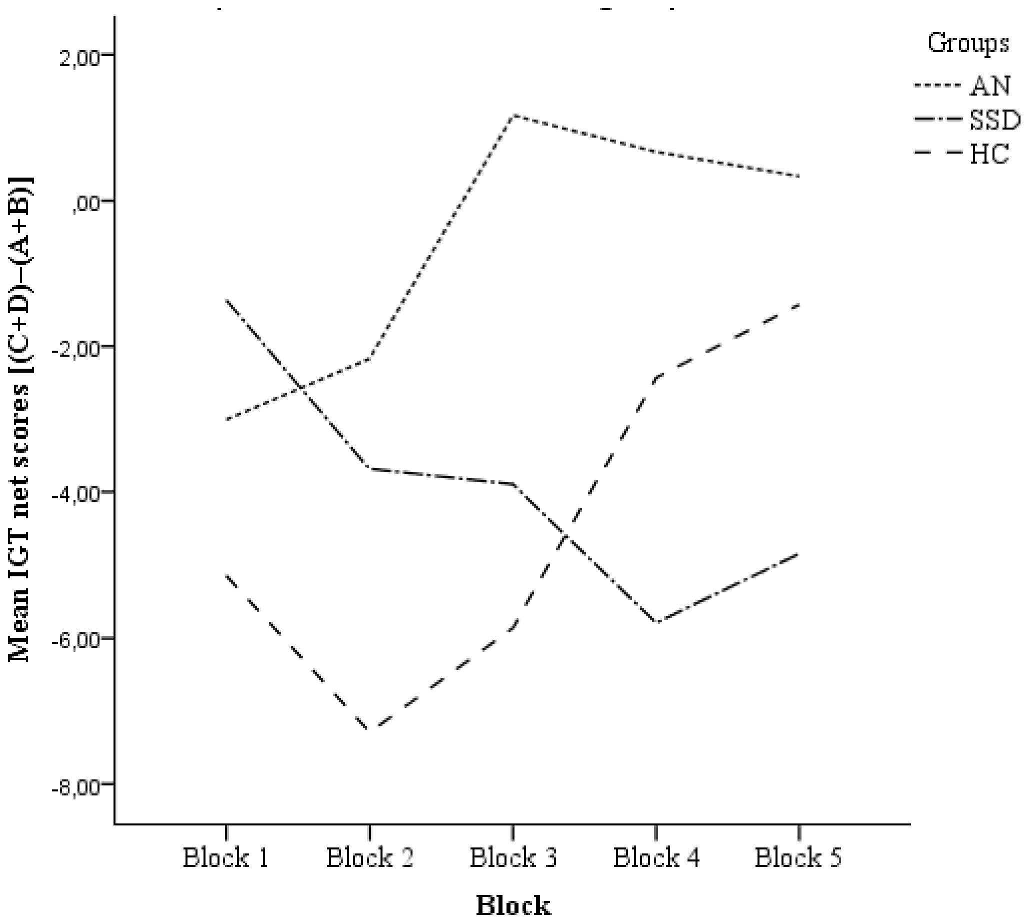

Figure 1. Performance (block net scores) in the Iowa Gambling Task over five blocks of 20 trials each

Moderation effect of expressive suppression

No significant interaction was found for Groups x Block x Suppression, $F(8, 156) = .98$, $p = .45$. This means that between the three groups no difference exists in the effect of the use of expressive suppression on decision making.

Discussion

The first aim of the present study was to examine decision making in patients with AN and patients with SSD, by evaluating their performance on the IGT in relation to healthy controls. To examine this, the learning effect on the IGT was compared between the three groups. Present results do not support our hypothesis that patient groups show more impaired decision making than the HC group, as there were no differences found on the IGT learning effect between the patient groups and HC. However, when we look more closely at our results, the groups showed a different learning pattern over the course of the five IGT blocks. Our results indicate a small learning effect in the HC group, in contrast to both patient groups. The non-significance of the overall learning effect in the HC group could be due to the small sample size of only 14 healthy participants. Although we found no statistically differences, our results clearly show different profiles in IGT performance between the three groups (see Figure 1).

The most noticeable is the IGT performance of the SSD patients. To our knowledge, this is the first time that decision making is investigated in SSD patients. Interestingly, our results show a decrease in IGT performance over time (see Figure 1), although this trend is nonsignificant. This could be a result of a lack of power, due to the small sample size. Therefore we think it is still useful to explore possible reasons for these findings. Besides this, the decrease in IGT performance may be nonsignificant, but present results clearly show no increase in IGT performance over time. This absence of an increase in IGT performance in SSD patients could be explained in different ways.

First, it could be due to dysfunction of somatic markers. The Somatic Marker Hypothesis states that impaired decision making in uncertain situations is a consequence of the lack of sensitivity to peripheral bodily alarm signals, or the failure to generate them (Damasio, 1996). These bodily signals are thought to underlie the IGT, which tests decision making under uncertainty. Our present results suggest that SSD patients might be insensitive to these somatic signals, or fail to activate them. Tchanturia and colleagues (2007) state that such lower activation of somatic signals could be a result of starvation, based on their finding that AN patients show lower somatic signal activation. However, present results show that the group with the highest BMI (SSD patients) have the lowest mean total IGT score, while the group with the lowest BMI (AN patients) have the highest mean total IGT score. This is in contrast to the hypothesis of Tchanturia and colleagues (2007). However, no conclusions can be drawn before the direct link between SSD patients and the activation of somatic markers (e.g. skin conductance) has been established.

A second explanation for the lower IGT performance in SSD patients could be the presence of rigidity difficulties. Bechara and colleagues (1997) explain how healthy participants switch in the IGT from one deck to another, based on trial and error. In the third block, they start to recognize the disadvantageous decks and their preference for the advantageous decks increases. The present results show how healthy controls start to get more gains after block three, while this is not the case in both patient groups (see Figure 1). The SSD patients continue to get more losses after deck three and the gains of AN patients stagnate at this point. This makes one wonder about the trial and error behavior of both groups. AN patients are already known to have set-shifting difficulties (Steinglass, Walsh & Stern, 2006; Danner et al., 2012), which means that if they are used to one behavior, it is hard to shift to other behavior. Lindner and colleagues (2012) state that the IGT assesses reversal learning, which does an appeal on the inhibition ability and set shifting. The mental inflexibility and rigid thinking style that is associated with AN (Danner et al., 2012), could cause stagnation on the IGT, because there is no reversal learning possible. Our results imply that SSD patients have reversal learning problems as well. A recent study of Hatta and colleagues (2019) shows that children with SSD have greater difficulty in attention switching compared to typically developing peers. Attention switching is thought to underlie inflexible behavior, which is characterized by behavioral rigidity and resistance to change (Gotham et al., 2013). This inflexible behavior could underlie the non-occurrence of trial and error behavior in the IGT, and therefore hinder reversal learning. Set-shifting and rigidity is theorized to be involved in the IGT (Smith, Xiao & Bechara, 2012), but there is almost no investigation of the direct link with IGT performance. Danner and colleagues (2012) found no negative association between set-shifting problems and IGT performance, but more research is needed to investigate this link.

Our finding regarding the non statistically significant different performance on a decision making task between AN patients and HC is in accordance with some previous studies (Bosonac, et al., 2007; Guillaume et al., 2010) but in contrast with the majority of the studies (Garrido & Subirá, 2013; Brogan, Hevey & Pignatti, 2010; Tchanturia et al., 2007; Cavedini et al., 2004). We expect that the contradictory results across studies is due to confounding factors. Guillaume and colleagues (2010) suggest that previous findings of impaired decision making in AN patients may be driven by the influence of medication use and high levels of depression. In addition, the different subtypes of AN could also be an important confounding factor, as Danner and colleagues (2012) found that the two subtypes of AN are associated with different decision making behavior. The binge-purge AN subtype was associated with impaired decision making, but the restrictive AN subtype showed adaptive decision behavior. Additional studies should control for these confounding factors, before investigating the link between AN and impaired decision making.

The second aim of this study was to test if there was a moderation effect of expressive suppression on the relation between the patient groups and impaired decision making. This moderation effect was not found, which implies that a higher use of expressive suppression is not linked to impaired decision making. This is not in line with previous research from Heilman and colleagues (2010). However, it is important to state that Heilman and colleagues (2010) manipulated the emotions of their participants. In the present study no such manipulation occurred. Heilman and colleagues (2010) stated that expressive suppression affects decision making under risk and uncertainty by failing to reduce the experience of negative emotions. The presence of negative emotions like anxiety is linked with impaired IGT performance (Miu, Heilman & Houser, 2008). Because the present study did not use any manipulation, it is most likely that the participants did not experience negative emotions while doing the IGT. Future research should incorporate the manipulation of negative emotions, to make a better indication about the moderation effect of expressive suppression on decision making.

The present study has a few limitations. The first limitation is the small sample size, therefore significant results and moderating effects could be missed due to limited power. Future research should include a greater sample, preferably with groups of the same size. A second limitation is the difference in age between the groups, where SSD patient were older than the other groups. Research shows that older participants choose less disadvantageous decks than younger people (Cauffman et al., 2010). This means that the present study would probably find bigger differences between IGT performance of SSD patients and the other groups when there would be controlled for age. Another limitation is that the present study did not control for factors which may impact upon IGT performance, like illness duration, IQ, attention, impulsivity or perfectionism. A last limitation is that the results are generalizable to AN females only, because there were no AN men included. Including males with AN is in future research desirable.

A strength of the current study was the use of validated questionnaires and tests. Another strength was using different patient groups. It is well known that psychiatric disorders are often comorbid, which is produced by the way we empirically identify these disorders (Cramer, Waldorp, van der Maas & Borsboom, 2010). The network theory is a new perspective that gained popularity in the past years (Fried et al., 2017). This theory suggests that different disorders are comorbid because there is a direct causal connection between the different symptoms (Cramer et al., 2010). This makes it even more interesting to include different disorders in the same study, to investigate the relation between different symptoms and characteristics between two or more disorders.

In sum, the present study did not find any statistically differences in decision making between SSD patients, AN patients and HC. This is in contrast to the previous studies that found an association between AN and impaired decision making. The contractionary findings regarding decision making of AN could possibly be explained by confounding factors. So more research is needed to gain insight in the factors that could influence decision making processes. Our study is the first that investigated decision behavior in SSD patients and found a tendency to maladaptive decision making behavior in situations of uncertainty. It is important to note that this was a non-significant finding, although we expect that this is due to power problems. Future research is needed to draw any conclusions about the decision making behavior of SSD patients. There is surprisingly little known about the characteristics of SSD patients, so it would be favorable to explore related factors like impulsivity, rigidity and set-shifting as well.

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