

The roles of the sensation-seeking personality trait and decision-making on anhedonia

Tamim Ansary

445217ta

First Supervisor: Prof. Dr. Ingmar Franken

Second Supervisor: Prof. Dr. Matthias Wieser

Course: Thesis & Internship

Master Clinical Psychology

Erasmus School of Social and Behavioral Sciences

Erasmus University Rotterdam

July 7th, 2022

Abstract

Previous research has indicated that there is a relationship between anhedonia and risky decision-making such as drug use, as well as nonpharmacological risky behavior such as skydiving. People high on the sensation-seeking personality trait have been associated with high scores on risky decision-making. However, there is lack of research about the relationship between sensation-seeking and anhedonia. In addition, anhedonia has been a common symptom of psychological disorders, most commonly depression. This may be contradictory, as depression has been linked to risk aversion. Therefore, the present study aims to clarify the multivariate relationship between anhedonia, risky decision-making, sensation-seeking, and depression. Assessing risky decision-making, the study uses a behavioral task, namely the Balloon Analogue Risk Task (BART). Measuring sensation-seeking, anhedonia and depression, the self-report questionnaires the brief sensation-seeking scale (BSSS), the Snaith-Hamilton Pleasure Scale (SHAPS), and Beck-Depression Inventory 1 (BDI-1) are used, respectively. The results do not indicate a relationship between risky decision-making and anhedonia, or between sensation-seeking and anhedonia. Risky decision-making is also not mediating the latter relationship. However, through exploratory analyses, we found a significant positive correlation between age and risky decision-making, age and sensation-seeking. This replicates previous findings that older people tend to do less risky behavior and being less impulsive than younger people. Furthermore, gender was correlated with both risky decision-making and sensation-seeking, which replicates male's higher tendency towards risky behavior than female. In addition, the present study could also replicate the positive relationship between depression and anhedonia, controlling for sensation-seeking and risky decision-making. This implicates depression's unique relationship with anhedonia.

Key words: risky decision-making, risky behavior, sensation-seeking, anhedonia, depression, behavioral measure

Anhedonia has been described as the inability or diminished capacity to experience pleasure (Gradin et al., 2011). Ho and Sommers (2013) characterize anhedonia as the decreased ability to enjoy experiences or activities that normally would be pleasurable (e.g., favorable drink, having a walk etc.). A necessity for feeling pleasure are reward processes (Berridge & Kringelbach, 2008) which involves liking, predicting, and approaching to achieve a desired goal (Kring & Barch, 2014). Accordingly, previous research indicated anhedonia's relations to dysfunctions in the reward system (Der-Avakian & Markou, 2012; Rizvi et al., 2016). This is in line with anhedonia being common in substance use disorders and commonly occurring as a withdrawal feature in people with drug addiction which may last for several years (Gawin, 1991; Markou & Koob, 1991; Volkow et al., 2002). Furthermore, past research (Destoop et al., 2019; Franken et al., 2007) established that people engaging in nonpharmacological high-risk activities (e.g., skydiving, gambling) experience heightened levels of anhedonic symptoms. Additionally, people with the sensation-seeking personality trait have been associated with a higher tendency of engaging in those risky behaviors (Heino et al., 1996; Hoyle et al., 2000; Raine, 2002; Wilson & Scarpa, 2011; Zuckerman, 1994). However, there is a lack of research about the correlation between the sensation-seeking personality trait and anhedonia. Furthermore, most studies on risky decision-making have used self-report measures. Therefore, in the present study, we used the behavioral measurement of risky decision-making, namely the Balloon Analogue Risk Task (BART) by Lejuez et al. (2002). In addition, previous research has studied the bivariate relationships between anhedonia and depression, or sensation-seeking and anhedonia. The present research aims to clarify the multivariate relationship between risky decision-making, the sensation-seeking personality trait, and anhedonia.

In addition to this multivariate relationship, anhedonic symptoms are seen in several psychiatric disorders, such as depression, schizophrenia, substance use disorder (Markou et al., 1998), Alzheimer's disease (Starkstein et al., 2005) and eating disorders (Davis & Woodside, 2002), thus anhedonia may act as an underlying feature across these diagnoses (Keedwell et al., 2005; Rizvi et al., 2016). Higher levels of depressive and anhedonic symptoms have been linked to

increased suicidal ideation and attempts, unemployment, comorbidity and lower social functioning (McDermut et al., 2003). Furthermore, as depression affects approximately 280 million people in the world (World Health Organization, 2021), it highlights the importance of examining its relationship to anhedonia. Since the DSM-III, anhedonia or the loss of interest is incorporated as one of the key symptoms of depression (Kessel & Klein, 2016). Previous research indicated the link between depression and its lower expectancy and value towards rewards (Must et al., 2013). Neurocognitive disturbances in executive functioning have been shown to be also impaired in depression and has also been detected in patients with major depressive disorder who are unmedicated (Porter et al., 2003). However, contrary to the relationship between risky decision-making and anhedonia, depression has been associated with risk aversion (Smoski et al., 2008). As this may seem contradictory to the research on anhedonia and risky decision-making, the present study aimed to clarify the relationship between depression and anhedonia, controlling for risky decision-making.

Risky decision-making and Anhedonia

Past research has thoroughly established higher rates of anhedonic symptoms in substance-dependent populations (Dorard et al., 2008; McGregor et al., 2005; Schmidt et al., 2001; Stevens et al., 2007). Anhedonia was correlated positively with the severity of the withdrawal symptoms of drug-dependency (Janiri et al., 2005; Martinotti et al., 2008). The systematic review by Garfield et al. (2014) established that in samples including a range of substance use disorder (dependence or abuse), anhedonic symptoms were elevated and that across longitudinal studies anhedonia seems to be a consequence rather than a cause of substance use. Additionally, the review established that anhedonia predicts cravings and relapse.

In addition to the relationship between risky drug use and anhedonia, the study by Franken et al. (2006) studied the relationship between non-pharmacological risky behavior and anhedonia. In this study, a high-risk group of skydivers was compared with a low-risk group of rowers on anhedonia. The study established higher reports of anhedonia on the self-administered questionnaire

Snaith-Hamilton Pleasure Scale (SHAPS) in the high risk-group. Suggesting that risky behavior such as drug abuse, gambling or skydiving all proceed by a person making a risky decision, this may demonstrate the possible important role of psychological underpinnings rather than anhedonia being solely a consequence of the pharmacological influence of drugs. In addition, the present study suggests that one necessary underpinning can be determined by the behavioral measure of risky decision-making.

Hypothesis 1: There is a positive correlation between risky decision-making and anhedonia

Sensation-seeking and Anhedonia

The sensation-seeking personality types seek “varied, novel, complex and intense sensations and experiences and willingness to take physical, social, legal, and financial risks for the sake of such experiences” (Zuckerman, 1994). This personality trait might be one further psychological underpinning of developing anhedonia. Research has been ongoing to find out what role personality plays in developing psychopathology, including anhedonia. Scoring high on this personality trait has been shown to be related to the tendency of engaging in risky behaviors such as drug abuse, sexual risk-taking (Hoyle et al., 2000), dangerous driving (Heino et al., 1996), and aggression (Raine, 2002; Wilson & Scarpa, 2011; Zuckerman, 1994). Detecting this personality trait, the sensation-seeking scales have been developed and extensively researched (Zuckerman & Neeb, 1979). From the theoretical perspective by Zuckerman (2007) the excitement and arousal in sensation-seekers, can be set off by certain stimuli which involve high risk experiences. Arousal, which is specific to sensation-seekers motivational trait characteristic, can be triggered by sequential risk tasks such as BART (Figner et al., 2009; Schonberg et al., 2011). In a recent meta-analysis, it has been found that sensation-seeking is correlated with risk-taking measured by BART in a small-moderate range, which suggests a correlation between sensation-seeking and risky decision-making which could be measured by a behavioral task (Lauriola et al., 2014).

Although there is an established relationship between risky behavior and anhedonia and the relationship between sensation-seeking and risky behavior, there is little to none research about the

association between the sensation-seeking personality trait and anhedonia. has been lacking about the association between the sensation-seeking personality trait and anhedonia. Our present study might further clarify this relationship. We suggest that sensation-seeking is correlated with risky decision-making measured by a behavioral task. Therefore, we suggest an additional correlation between sensation-seeking and anhedonia, mediated by risky decision-making.

Hypothesis 2: There is a positive correlation between sensation-seeking and anhedonia

Hypothesis 2a: The correlation between sensation-seeking and anhedonia is mediated by risky decision-making

Anhedonia and Depression

Determining if risky decision-making is specific to anhedonia, we intend to clarify its unique relationship with depression. Past research by Tolentino and Schmidt (2018) has shown that the presence of anhedonia is the most reliable factor for differentiating severe depression (SD) from mild depression (MD). There has been no relationship established between sensation-seeking and general psychopathology, except that people with a reported history of manic-depressive or sociopathic symptoms, including substance use disorder, scored higher on sensation-seeking (Zuckerman & Neeb, 1979). People who are depressed may experience symptoms such as significant weight change, sleep disturbances, concentration problems, feelings of worthlessness and extreme levels of guilt up to suicidal ideation. To diagnose this disorder, according to DSM-5 there are two criteria, of which at least one needs to be met. First, depressed mood or second, experience a lack or loss of interest in their daily tasks, namely anhedonia, over the period of the last two weeks. The past research by Treadway et al. (2012) that patients with major depressive disorder were less likely to put efforts towards rewards and used less effectively information to guide their decisions toward reward. Therefore, we suggest depression is associated with anhedonia, independently of risky decision-making.

Hypothesis 3: Depression is positively correlated with anhedonia, also after controlling for risky decision-making and sensation-seeking

Methods

Participants and Procedure

In the present study our sample consisted of 359 voluntary participants, who participated in the study after being given informed consent. The statistical power analysis G*Power by Faul et al. (2009) had concluded a required sample size of 68 to be sufficient for yielding a medium effect size ($d = .15$). The participants were recruited through the distribution of the questionnaire link via social media to the general public. Compensation was not given, however the possibility of winning 50 Euros when finishing the questionnaire and balloon-analogue-risk-task was given, if the participant provided his or her e-mail when finishing the risk-task. For this research, participants completed this survey including variables regarding demographics, BDI, SHAPS, and BART. Before starting the survey, informed consent was given.

The research we conducted received approval by the Ethics Review Committee DPECS at the Erasmus School of Social and Behavioral Sciences (ESSB). We granted participants access to the survey platform *qualtrics* via an online link. The survey could be filled via phone or computer from anywhere. Recruitment and data collection started on the 18th of March 2021 and ended on the 2nd of April 2021. The time needed to fill out the questionnaire was approximately 15-20 minutes. At the start of the questionnaire each participant was provided with informed consent regarding general information about confidentiality, voluntary participation, and duration of the questionnaire. Contact information was given, if questions would like to be asked by any partaker to the researchers. Following the informed consent, questions were asked about demographics and several surveys, respectively. Finally, before finishing the questionnaire with the BART, participants were asked if they want to take part opportunity to win 50 euros for the best performance. If participants were willing to take part in the final balloon task, they got the opportunity to enter their email to get contacted if they have won the prize. All sensible data were deleted once the winners were identified.

Measures

Sensation-Seeking. We measured this variable with the Brief Sensation-Seeking Scale (BSSS) by Hoyle et al. (2002). This scale consists of 8 Items, and each is rated on a five-point likert scale from 1=strongly disagree to 5 = strongly. Examples of items are “I would like to explore strange places”, or “I would like to try bungee jumping”. Similar to the original version, the brief scale encompasses the 4 subscales of sensation-seeking, attributing 2 items to each. The total score ranges from 8 to 32, and a higher score indicates a higher level of sensation-seeking. Similar to the sub scales of the original SSS-V scale: Thrill and Adventure Seeking indicates the tendency to engage or interest in dangerous or risky activities (e.g. skydiving); Disinhibition reflects the loss of control over the own behavior in social situations; Experience Seeking indicates the desire to seek out new experiences (e.g. travel to new places); Boredom Susceptibility refers to the tendency to avoid repetitive and monotone situations, people or activities (Zuckerman & Neeb, 1979). The BSSS has reported high internal consistency and test-retest correlations (Hoyle et al., 2002). For Dutch speaking participants the Dutch version of the BSSS was included (Van Dongen et al., 2011).

Risky decision-making. As a behavioral measure of risky decision-making, the Balloon Analogue Risk Task (BART) by Lejuez et al. (2002) was used at the end of the questionnaire. On the participants screen, an illustrated balloon could be inflated or exploded. This was displayed by the balloon growing and by the balloon bursting, respectively. This version of BART we used consisted of 10 trials. The task was presented on the participants screen, showing a small red balloon and two buttons on the screen: one for inflating and one for collecting the points earned. Another button could be used to stop pumping and taking the points. Each time the participant pumped the balloon, its size increased. The explosion of the balloon was illustrated by the bursting of the balloon. Furthermore, the points earned in the current round, number of pumps, points won last round, total points were displayed at the bottom of the screen. For each pump, the participant could earn 1 point, when deciding to collect before the explosion of the balloon.

Depression. The Beck Depression Inventory (BDI-1) by Beck et al. (1996) consists of 21 items, which measured current symptoms of depression such as prolonged sadness (e.g., “I feel sad”) or sleep disorder (“I wake up several hours earlier than I used to and cannot get back to sleep”). Each item had 4 response categories and higher values indicating a higher severity of the symptoms.

Anhedonia. The Snaith-Hamilton-Pleasure Scale (SHAPS) by Snaith et al. (1995) was used to measure the present state of anhedonia. This scale consisted of 14 items with 4 response categories on a 1-4 Likert scale ranging from “definitely agree” to “definitely disagree”. Examples of items are “I would enjoy my favorite television or radio programme” or “I would enjoy a cup of tea or coffee or my favorite drink”. The total score indicates the level of state anhedonia. This scale has reported high internal consistency (Cronbach’s $\alpha = 0.857$) and test-retest correlations ($r = 0.74$).

Data Processing

The collected Data was analyzed using SPSS 24 (IBM Corp., Armonk, NY, USA). For the first hypothesis, the independent variable was risky decision-making and the dependent variable was anhedonia. For hypothesis 2, the independent variable was the sensation-seeking personality trait, and the dependent variable was anhedonia. Additionally, hypothesis 2a included risky decision-making as the mediating variable. Furthermore, the third hypothesis consisted of anhedonia as the dependent variable and both sensation-seeking and risky decision-making as the independent variables. Depression was added as a covariate to analyze its effect on the regression model. In this study, a correlational and hierarchical regression analysis was performed. The mediation analysis could be performed with the SPSS extension “PROCESS”(Hayes, 2012).

Data Analysis

Before the start of the analysis, missing or invalid data (e.g., impossible values) were removed. Eventually, 2 missing cases were filtered out from the complete dataset. Missing cases were removed pairwise in the analysis. We examined existing outliers through scatterplots,

standardized residuals, and Cooks values. Several outliers were found in the surveys measured. Taking the rule of thumb established by Howell et al. (1998) the standard deviations should not exceed -3 or +3. Therefore, within the Anhedonia-scale, one case ($SD = -3,56$) was removed and within the BID-Scale 3 cases were removed ($SD = 3,33; 3,41; 3,06$) due their large, standardized residuals. In preparation for the analysis, several assumptions must be met. Although inspecting histograms and a significant Shapiro-wilk test there is an indication of non-normality for depression ($W_{BDI-I}(284) = 0.97, p < .001$) and anhedonia ($W_{SHAPS}(284) = 0.94, p < .001$). However, normality can be assumed due to the Central Limit Theorem, as with large sample sizes normality can be still considered. Furthermore, as participants filled out the questionnaire separately, independence of observation can be assumed. Additionally, there was no multicollinearity between our predictor variables and the residuals of the measured variables were normally distributed. Therefore, the assumptions for the performed hierarchical regression analysis have all been met.

For all hypotheses tests, a one-tailed significance level of .05 was set prior to the analysis. The Pearson correlation (two-tailed) was conducted to examine if there is a positive association between risky decision-making and anhedonia (hypothesis 1) and between sensation-seeking and anhedonia (hypothesis 2). To test hypothesis 2a on the mediating effect of risky decision-making on the relationship between sensation-seeking and anhedonia, a mediation analysis using the SPSS extension "PROCESS" (Hayes, 2012) was used. To test hypothesis 3, a regression analysis was used with the independent variables of sensation-seeking, risky decision-making and the dependent variable anhedonia. Depression was added as a variable stepwise.

Results

Descriptive Statistics

Descriptive statistics and frequencies were used to display the demographic data of the participants. From this sample 41.8% identified as male and 58.2% as female (Table 1). The participants ranged in age from 17 to 80 years ($M = 36.53$ years, $SD = 15.41$). Moreover, most of the participants currently live in the Netherlands, Egypt, and United Arab Emirates. The means

and standard deviations on the measured variables anhedonia ($M = 8.40$, $SD = 5.35$), depression ($M = 1.70$, $SD = .52$), risky decision-making ($M = 9.74$, $SD = 4.05$), sensation-seeking ($M = 23.06$, $SD = 6.35$) are shown in Table 2.

Table 1

Demographic characteristics of the total sample (N=354).

Demographic Variable	n	%
Gender		
Male	148	41.8
Female	206	58.0
Other	0	0
Current Residence		
Living in the Netherlands	192	54.2
Living in Egypt	103	29.1
Living in United Arab Emirates	16	4.5
Living in Germany	10	2.8
Living in United States of America	5	1.4
Other	28	8

Table 2

Descriptive statistics of anhedonia, depression, risky decision-making, and sensation-seeking

	Minimum	Maximum	Mean	Std. Deviation
Anhedonia (SHAPS)	.00	27.00	8.40	5.35
Depression (BDI-1)	1.00	3.43	1.70	.52
Risky decision-making (BART)	1.00	20.30	9.74	4.05
Sensation-seeking (BSSS)	8.00	39.00	23.06	6.35

Correlational Analysis

Table 3 presents the correlations between all measured variables. The results only indicate a small positive correlation between sensation-seeking and depression

$[r_{\text{sensationseeking,depression}}(354) = .118, p < .027]$, and a small positive correlation between

anhedonia and depression $[r_{\text{anhedonia,depression}}(354) = .238, p < .027]$. Therefore, hypothesis 1

and 2 cannot be supported in the present research.

Table 3*Correlations between anhedonia, depression, risky decision-making, and sensation-seeking*

		1	2	3	4	5	6
1. BSSS	Pearson Correlation	1	-.025	.118*	.072	-	-
	Sig. (2-tailed)		.671	.027	.177	<.001	.132*
2. BART	Pearson Correlation	-.025	1	-.019	-.052	-	-.093
	Sig. (2-tailed)	.671		.748	.380	.008	.118
3. BDI	Pearson Correlation	.118*	-.019	1	.238*	-.079	.088
	Sig. (2-tailed)	.027	.748		<.001	.136	.100
4. SHAPS	Pearson Correlation	.072	-.052	.238*	1	-.091	-
	Sig. (2-tailed)	.177	.380	.000		.088	<.001
5. Age	Pearson Correlation	-	-	-.079	-.091	1	-.012
	Sig. (2-tailed)	<.001	.008	.136	.088		.827
6. Gender	Pearson Correlation	-	-.093	.088	-	-.012	1
	Sig. (2-tailed)	.132*	.118	.100	<.001	.827	

*p<.05 (2-tailed)

Mediation Analysis

To examine the mediation effect of risky decision-making on sensation-seeking and anhedonia, the output of the matrix by PROCESS is illustrated and simplified in Figure 1. For this analysis the outcome variable was risky decision-making, and the predictor variable was sensation-seeking. The mediator variable examined was risky decision-making. There was no effect of sensation-seeking on anhedonia, no effect of sensation-seeking on risky decision-making and thus no mediation effect.

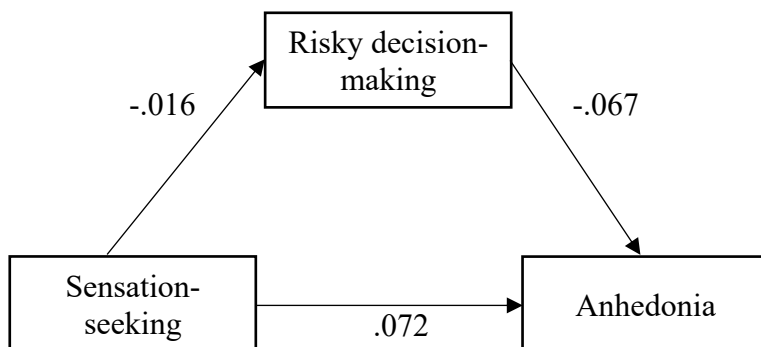
The Relationship between anhedonia and depression, controlling for sensation-seeking and risky decision-making

As there is neither a correlation between the independent variable sensation-seeking or risky decision-making and the dependent variable anhedonia, controlling for them is redundant. As depression and anhedonia are positively correlated [$r_{\text{anhedonia,depression}}(354) = .238, p <$

.027], this may display a unique relationship, independent of sensation-seeking or risky decision-making.

Figure 1.

Coefficients of mediation model for the relationship between sensation-seeking and anhedonia, including risky decision-making as a mediator



The Relationship between anhedonia and depression, controlling for sensation-seeking and risky decision-making

As there is neither a correlation between the independent variable sensation-seeking or risky decision-making and the dependent variable anhedonia, controlling for them is redundant. As depression and anhedonia are positively correlated [$r_{\text{anhedonia,depression}}(354) = .238, p < .027$], hypothesis 3 is therefore supported, this may display a unique relationship, independent of sensation-seeking or risky decision-making.

Exploratory Research: Age and Gender

Furthermore, the present research performed exploratory research. Table 3 indicates several relationships with age and gender. There is a moderate negative correlation between age and sensation-seeking [$r_{\text{age,bsss}}(354) = -.238, p < .001$]. Therefore, the present study established that as age increases, the score on the brief sensation-seeking scale decreases. Furthermore, there is a small negative correlation between age and risky decision-making [$r_{\text{age,bart}}(354) = -.157, p < .05$]. In this study, the higher the age of participants, the lower was the score on the behavioral measure BART. For gender, the present study found a small negative correlation between gender

and sensation-seeking [$r_{gender,bsss}(354) = -.132, p < .05$] and a small negative correlation between gender and anhedonia [$r_{gender,shaps}(354) = -.191, p < .001$]. As 2 was coded for females and 1 for males, this means that females scored lower on sensation-seeking and anhedonia overall.

As age and gender therefore might be confounding variables, the present research performed a hierarchical regression analysis, in which two models have been used. Model 1 predicted anhedonia from age and gender and model 2 added risky decision-making and sensation-seeking. Model 2 did not account for a significant amount of variance, and thus age and gender did not perform as confounding variables.

Discussion

The present study aimed to clarify the multivariate relationship between sensation-seeking, risky decision-making, and anhedonia. Furthermore, risky decision-making, measured by the Balloon Analogue Risk Task (BART) was included as a mediator to determine if the relationship between sensation-seeking and anhedonia is affected by the extent of risky behavior. This study reached a large and heterogenous sample size of 354 participants, after removing invalid or missing data. Previous research has indicated a relationship between risky decision-making and anhedonia (Franken et al., 2006; Markou & Koob, 1991; Martinotti et al., 2008). Contradictory to this relationship would be the relation of anhedonia with depression, as this disorder has been linked to risk aversion (Smoski et al., 2008). Therefore, the present study suggested the relationship between depression and anhedonia, being independent of risky decision-making and sensation-seeking.

Furthermore, the present study could not support the second hypothesis assuming the relationship between sensation-seeking and anhedonia. This is contrary to a previous study by Carton et al. (2000), which found a relationship between these two variables. However, in that study the Abrams-Taylor Scale for Scale for emotional blunting (Abrams & Taylor, 1978) was used to measure anhedonia. Even though the present results do not replicate a relationship between anhedonia and risky behavior, the present study's results might clarify the implication by Franken et

al. (2006) on the relationship between sensation-seeking, risky behavior and anhedonia. The present results do not indicate that sensation-seeking acts as a psychological underpinning. In addition, the implication by Franken et al. (2006) that anhedonia may be a direct result of risky behavior, cannot be supported by measuring risky behavior by BART. Therefore, future research also needs to implement a variety of measures of risky behavior and decision-making to clarify this relationship. Moreover, the present study could not support a relationship between sensation-seeking and risky decision-making. This is contrary to the meta-analysis by Lauriola et al. (2014) which found that sensation-seeking is correlated with risk-taking measured by BART in a small-moderate range.

Conflicting with past research (Lauriola et al., 2014) the present study has not found a relationship between risky decision-making and anhedonia. Furthermore, no relationship between sensation-seeking and anhedonia could be established. Previous studies had indicated a relationship used self-report measurements to assess risky behavior with declarations on real-life risk behavior (e.g., Skydiving, drug abuse) (Franken et al., 2006; Garfield et al., 2014; Martinotti et al., 2008; Stephenson et al., 2003). As the present research, in contrast, applied the behavioral measure task BART at the end of an online survey. The results may indicate that BART did not measure the same risky behavior as measured in previous studies. This supports the study by Bernoster et al. (2019), that self-report, neurological assessment and behavioral tasks do not measure the same construct related to reward processing.

The present study could replicate the relationship between anhedonia and depression. In addition, as neither sensation-seeking nor risky decision-making was related to anhedonia, this supports the third hypothesis, that depression and anhedonia are uniquely related, independent of sensation-seeking or risky decision-making. As previous studies indicate general impairment in executive functioning and decision-making in depression (Bishop & Gagne, 2018), future research should aim to clarify the relationship between risk aversion and risk behavior towards depression and anhedonia.

In an exploratory analysis we could confirm the effect of age on sensation-seeking and risky decision-making. The younger participants in this study were higher on sensation-seeking and scored higher on risky decision-making. This is in line with previous research (Deakin et al., 2004; Worthy et al., 2011). For sensation-seeking, it has been shown that sensation-seeking spikes young adolescents between 10-15 years of age and decline or stabilize afterwards (Steinberg et al., 2008). Future research may include therefore a wider age range and examine differences in anhedonic symptoms.

For gender, it has been found that there is a small correlation between gender and sensation-seeking. This is in line with the previous research that males tend to have an overall higher score in sensation-seeking (Zuckerman et al., 1991). The present study could not find a relationship between gender and risky decision-making. This contrasts with the previous study by Deakin et al. (2004) showing that male participants tend to take more risk, when there is a possibility of winning.

Limitations

The present study suffers from several limitations. The variables assessed in this research are measured by self-report. Semi-structured interviews by trained researchers could more accurately depict clinical symptoms of anhedonia and depression. Furthermore, BART might not measure risky decision-making, as it was performed in an environment which is safe and does not involve real-life risks as in skydiving or drug use. Therefore, future research should include a variety of measurements for this variable. Moreover, the variables depression and anhedonia might suffer from non-normality by investigating the scatterplots. This might be due to the population, which consists of family members and friend from university students. Depressive symptoms might be underrepresented in such a sample. Future research should include people with severe depressive symptoms.

Conclusion

The present research could replicate the relationship between depression and anhedonia. Furthermore, the relationship stays stable when risky decision-making, and sensation-seeking are controlled for. In addition, the present study could replicate previous findings that younger people who are male, tend to score higher on sensation-seeking. This study could not establish a relationship between risky decision-making and anhedonia, which contrasts with previous research. Future research, therefore, should implement a variety of measures of risky decision-making to clarify this relationship.

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