Decision-making under ambiguity in patients with social anxiety disorder

Hasan Demirci[1], Efruz Pirdoğan Aydın[2], Bekir Alp Kamazoğlu[3], Ömer Akil Özer[4]
[1]Assis. Prof, Department of Psychology, University of Health Sciences, Istanbul, Turkey https://orcid.org/0000-0002-2948-0314
[2]Assoc. Prof, [3]M.D., [4]Prof, Department of Psychiatry, Sisli Hamidiye Etfal Training and Research Hospital, University of Health Sciences, Istanbul, Turkey https://orcid.org/0000-0001-6056-0075, https://orcid.org/0009-0007-9495-5551, https://orcid.org/0000-0001-5565-4640

SUMMARY

Objective: The study aimed to compare the decision-making functions of patients with social anxiety disorder (SAD) under ambiguity with healthy controls.

Method: Seventy-nine patients with SAD (47 with generalized subtype, and 32 with nongeneralized subtype) were included in the study. The healthy control group consisted of 72 individuals who were matched with the patient group in terms of age, sex, and education. Sociodemographic Data Form, Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI), Liebowitz Social Anxiety Scale (LSAS), Barratt Impulsiveness Scale-Short Form (BIS-15), and Iowa Gambling Test (IGT) were administered to all participants.

Results: The decision-making performance of patients with SAD was similar to healthy control group. In SAD subtypes, the generalized type performed poorly in the IGT compared with the nongeneralized subtype type. Participants with nongeneralized subtype increased their performance by choosing more advantageous decks after the first 20 card selections and showed a learning effect. Those with generalized type showed a learning effect only in block 5 and continued to choose from disadvantageous cards in the other blocks.

Discussion: Patients with SAD preferred advantageous decks like healthy control group and learned to avoid disadvantageous decks. The decision-making performance of the generalized type was impaired. The generalized subtype made choices that won in the short run but lost in the long run and did not benefit from feedback. We believe that this separation in decision-making processes among SAD subtypes will contribute to a better understanding of the types.

Key Words: Social anxiety disorder; ambiguity; decision-making; generalized subtype; nongeneralized subtype

INTRODUCTION

Social anxiety disorder (SAD) is a psychiatric disorder in which a person has a fear of being humiliated in social situations and being judged by others, and has a distinct and constant fear regarding this issue (1). The prevalence rates of SAD in various countries vary between 4-16% (2). SAD is associated with impairment in important areas of daily life such as professional/academic, relationships with others, and social activities (3). Major risk factors such as genetic predisposition, environmental and developmental factors, personality traits, insufficient social support, restricted social environment, and negatively perceived parenting style have been associated with the etiology of SAD (4–8). Epidemiologic studies reveal that the rate of SAD is high in women (9). However, the higher treatment-seeking rate among men can be attributed to the greater functional impairment they experience as a result of SAD (2,9).

Although the classification of subtypes of SAD remains controversial, it has been divided into two

DOI: 10.5505/kpd.2023.82713

Cite this article as: Demirci H, Pirdogan Aydin E, Kamazoglu BA, Ozer OA. Decision-making under ambiguity in patients with social anxiety disorder. Turkish J Clin Psych 2023; 26:282-292

The arrival date of article: 03.03.2023, **Acceptance date publication:** 16.06.2023

Turkish J Clinical Psychiatry 2023;26:282-292

subtypes: generalized and nongeneralized for diagnostic purposes (2,10,11). The generalized type of SAD includes people who are fearful of many social situations that require interpersonal relationships (2,9). The nongenaralized type includes only one or a limited number of people who experience fear in different social situations (12). The generalized type fears and avoids almost any social situation that requires interpersonal contact or that they think will be watched by others (12,13). The generalized type is usually earlier and shows familial transition (1,14,15).

In neuropsychological research, decision-making behavior is examined with two different paradigms as decision-making under risk and decision-making under ambiguity (16,17). In the decision-making at-risk paradigm, information about possible outcomes and information about reward-punishment probabilities is clear (17,18). In decision-making under ambiguity, the probability of reward-punishment is uncertain, and the prior information about the results is implicit (17). The decision-making task in uncertain situations is often tested using the Iowa Gambling Test (IGT) (19–21). This task is an experimental test that includes components such as uncertainty, reward, and punishment, simulating decision-making in real life (19). To be successful in this task, participants must implicitly understand the rules of the task based on the feedback they receive after the choices they make (17). Understanding implicitly means it is difficult for the participants to follow and remember their earnings and losses from the previous card selections (16,17). Instead, the participants must follow their emotions and prerequisite in accordance with the somatic marker hypothesis (SMH) (22,23). According to the somatic marker hypothesis, emotions guide decision-making when the outcome of one's choices regarding reward and punishment is uncertain (24). Emotions consist of somatic changes. These somatic states emerge in the decision-making process and work as an automatic alarm, marking specific options as advantageous and the left as disadvantageous (24,25). Somatic markers work like automatic alarms in uncertain situations, marking response options with an emotional signal (25). Automatic alerts protect against future harm before things go any further and enable accurate decision-making from fewer options (22).

Many studies used the IGT task to evaluate decision-making disorders in psychiatric disorders (26–34). In these studies, poor performance findings in decision-making were obtained in patient groups. There are few studies in the literature evaluating decision making under uncertain situations in social anxiety. Some of these studies only included individuals with social anxiety variants who were not formally diagnosed (35,36). Another study in the literature included only participants with SAD (37). Decision-making behavior under ambiguous situations has not been previously studied between patients with SAD and healthy controls (HCs). It has been shown that IGT, which evaluates decision-making in uncertain situations, is sensitive to orbitofrontal/ventromedial prefrontal cortex and limbic system functioning (18,20,38,39). We think that evaluating the decision-making paradigm with a specific neuropsychological task sensitive to this region of the brain will contribute to research on the etiology of SAD. The primary aim of our study was to compare decision-making function under uncertain situations in patients with SAD with HCs. The secondary aim of our study was to investigate the differences in decision-making between generalized and nongeneralized types. Finally, we aimed to assess the relationship between decision-making and depression, anxiety, avoidance, and impulsivity.

METHOD

Participants and procedure

The investigation was performed with patients with SAD, all were diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) criteria by two psychiatrists in the outpatient clinic of the Department of Psychiatry, Sisli Hamidiye Etfal Training and Research Hospital, University of Health Sciences in Istanbul, Turkey. The Comorbidities of patients were determined using the Structured Clinical Interview for DSM-5 (SCID-5-CV). The inclusion criteria for the study were as follows: being diagnosed as having SAD according to the DSM-5, being aged 18-50 years,

being at least a primary school graduate, and agreeing to participate in the study. The inclusion criteria for HCs were the same, except there was no current or lifetime history of any psychiatric disorder. Exclusion criteria of the study were intellectual disability, schizophrenia and other psychotic disorders, bipolar disorder, history of any neurologic disease, and alcohol or substance abuse. After the selection of the patient groups was made according to the purposeful sampling method, 72 people who were matched with the patient group in terms of age, sex, and educational status, were included in the study as the control group. Twenty-five of the patients with SAD had no comorbidities. Forty-seven patients with SAD had one or more comorbidities (adult separation anxiety n=5, agoraphobia n=2, anxiety disorder n=1, another defined anxiety disorder n=7, attention-deficit/hyperactivity disorder n=13, eating disorder n=1, generalized anxiety disorder n=3, major depressive disorder n=16, obsessive-compulsive disorder n=8, panic disorder n=1, skin picking disorder n=5, somatic symptom disorder n= 3, trichotillomania n=4).

Psychiatrists who conducted the clinical interviews identified 47 of the 79 patients with SAD as having generalized type and 32 as having nongeneralized type. Those with anxiety/avoidance in two or more different social situations were considered as having the generalized type, and those with anxiety/avoidance in a single area were considered as having the nongeneralized type (40). Sociodemographic Data Form, Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI), Liebowitz Social Anxiety Scale (LSAS), Barratt Impulsiveness Scale-Short Form (BIS-15), and Iowa Gambling Test (IGT) were administered to all participants. After explaining the purpose and method of the study to the participants, their written informed consent was obtained. The study was conducted in conformity with the Declaration of Helsinki and was approved by the ethics committee of Sisli Hamidiye Etfal Teaching and Research Hospital, University of Health Sciences in Istanbul, Turkey (3615/2022).

Assessments

Sociodemographic Data Form: This detailed interview form was prepared by the researchers for the study, evaluating the sociodemographic characteristics of the patients, the onset and course of the disease, their clinical status, and the clinical diagnosis process.

Structured Clinical Interview for DSM-5-Disorders-Clinician Version (SCID-5/CV): SCID-5/CV is a semi-structured interview guide that was developed to diagnose DSM-5 disorders. SCID-5 was developed by First et al. in 2015 (41) This guide can be administered by physicians or trained mental health professionals familiar with the DSM-5 classification and diagnostic criteria. Adaptation, validity, and reliability studies were conducted for Turkish society (42)

Beck Depression Inventory (BDI): The BDE was developed to determine the presence and severity of depressive symptoms in adults (43). The scale consists of 21 items, and each item is scored between 0 and 3. The total score ranges from 0-63. The high total scores obtained from the scale indicate severe depression. The cut-off point of the scale is 17. A validity and reliability study was conducted for use in the Turkish population (44).

State-Trait Anxiety Inventory (STAI): The STAI was developed by Spielberger et al. (45). The STAI consists of two separate scales with a total of 40 items. The state anxiety scale includes questions about how the person feels at a certain moment and under certain conditions. The trait anxiety scale, on the other hand, includes questions about how the person usually feels. The total score obtained from both scales varies between 20 and 80. High scores indicate high anxiety and low scores indicate low anxiety. A validity and reliability study was conducted for use in the Turkish population (46).

Liebowitz Social Anxiety Scale (LSAS): The LSAS scale, which evaluates the severity of fear and avoidance in social environments and situations requiring performance, was developed by Liebowitz (47). It consists of a total of 24 questions, 11 of which evaluate social situations and 13 questions that evaluate situations that require performance. For each situation, the individual's anxiety and avoidance levels are scored between 0 and 3.

The higher the score obtained, the worsening of social anxiety and avoidance. A validity and reliability study was conducted for use in the Turkish population (48).

Barratt Impulsiveness Scale-Short Form (BIS-15): The BIS-15 scale is a 15-item self-report scale that evaluates the impulsivity structure. Items are rated on a 4-point Likert-type scale (1=rarely/never; 2 = sometimes; 3=often; 4=almost always / always). It consists of three sub-dimensions: non-planning (BISnp), motor impulsivity (BISm), and attentional impulsivity (BISa). Higher scores are indicative of higher levels of impulsiveness. A validity and reliability study was conducted for use in the Turkish population (49).

Iowa Gambling Test (IGT): The IGT was developed to evaluate decision-making behavior under uncertain situations. (19,50). In this test, the participants are given an advance of 2000 TL as computer money at the beginning. Participants are instructed to make as much money as possible and lose as little money as possible during the test by making choices from four different decks of cards (A,B,C,D) displayed on the computer screen. They are informed that they can choose as much as they want from each deck and switch from one deck to the next. The participant chooses a total of 100 cards, but this information is not given to the participant. The decision-making behavior among the decks varies according to the reward and punishment obtained as a result of the card selected from each deck. These rewards and punishments are pre-programmed and known to the tester, but not to the participant. A and B decks are risky decks that make a lot of money but also lose a lot of money in the long run. C and D decks are advantageous and risk-free in the long run, with little gain and little loss. Participants are expected to learn this rule as the test progresses. In a selection of 100 cards, choosing more from decks A and B results in a net loss, while choosing more from decks C and D results in a net win. In the selection of 100 cards in total, the selections made from the advantageous decks (C and D) are subtracted from the selections made from the disadvantageous decks (A and B), and the advantageous decision performance during the IGT is calculated. A high score indicates good decision-making performance. A validity and reliability study was conducted for use in the Turkish population (51).

Statistical analysis

The SPSS version 20.0 for Windows software package (SPSS, Inc., Chicago, Illinois) was used for statistical analysis. Descriptive statistics, mean and standard deviation, were used for numerical variables, and categorical variables are reported as numbers and percentages. Comparisons of numerical variables in two independent groups were made using Student's t-test under normal distribution conditions, and the Mann-Whitney U test when normal distribution conditions were not met. A comparison of rates in independent groups was made using Chi-square Analysis. Analysis of covariance (ANCOVA) was used to compare the IGT blocks, and total scores by controlling age, education status, STAI, and BDI scores in paired groups. In cases where IGT scores did not meet normal distribution conditions, Quade's ANCOVA analysis was performed by transforming age, education status, STAI, BDI scores, and dependent variables into ordinal values. Pearson's correlation analysis was used when the correlations between variables were provided with normal distribution conditions, and when normal distribution was not achieved, Spearman's correlation analysis was used. Statistical alpha significance level was accepted as $p<0.05$.

RESULTS

Social anxiety disorder versus health control

There were 151 participants, including 79 with SAD, and 72 HCs. Sociodemographic characteristics and clinical scale scores of the patient and control groups are compared in Table 1. There was no statistically significant difference between the patient and control groups in terms of age ($p=0.554$), sex ($p=0.167$), and education years ($p=0.133$). Depression and anxiety (STAI-1, STAI-2) scores of patients with SAD were significantly higher than in the HCs ($p<0.001$, Cohen's $d=1.32$, $p<0.001$, Cohen's $d=1.31$, and $p<0.001$, Cohen's $d=1.62$, respectively). LSAS-anxiety and LSAS-avoidance scores of patients with SAD were statis-

Table 1. Demographic features, clinical data, impulsivity, and decision-making scores of the participants

					Quade's ANCOVA		
Variables	SAD (n=79)[a]	HC (n=72)[a]	t, Z, x†	P	F	P	n2
Age (yr)	24.8–6.1	25.1–5.7	0.592[b]	0,554			
Sex (Female), n (%)	35(44.3)	40(55.6)	1,908[c]	0,167			
Education (yr)	14.2–2.8	14.9–2.2	-1,512[b]	0,133			
BDI scale scores	21.1–12.5	7.7–7	-6.877[d]	<0.001			
STAI-1 (state)	46.6–11.3	33.2–9.1	7,971[b]	<0.001			
STAI-2 (trait)	55.9–11.8	38.2–10	9,859[b]	<0.001			
LSAS-fear	59.1–15.2	41.5–11	8,108[b]	<0.001			
LSAS-avoidance	55–15.8	37.1–8	-7.406[d]	<0.001			
BIS-15np	11–3	9.2–2.4	-3.508[d]	<0.001			
BIS-15m	10.7–3.1	8.7–2.4	-3.961[d]	<0.001			
BIS-15a	10.7–3.5	8.6–2.3	-3.967[d]	<0.001			
BIS-15total score	32.5–8.6	26.5–6	4,968[b]	<0.001			
IGT-1 (1-20)	-2–4.4.3	-2.2–4.3	-0.115[d]	0,908	0,643	0,424	0,004
IGT-2 (21-40)	- 0.5–4.2	-0.2–3.6	-0.578[d]	0,536	0,004	0,95	-
IGT-3 (41-60)	-0.1–4.5	0.4–5.1	-0.081[d]	0,935	0,015	0,902	-
IGT-4 (61-80)	-0.4–5.1	0–5.7	-1.142[d]	0,253	0,521	0,472	0,003
IGT-5 (81-100)	1.1–6.4	-0.3–8.3	-0.935[d]	0,34	0,617	0,433	0,004
IGT-total score (1-100)	-2–15.3	-2.4–16.3	-0.203[d]	0,839	0,007	0,932	-

Abbreviations: BDI: Beck depression inventory scale, BSIa: Barratt Impulsiveness Scale-Short Form- attentional impulsivity, BIS-15m: motor impulsivity, BIS-15np: non-planning, IGT: Iowa Gambling Test, Hc: Healthy control, LSAS: Liebowitz Social Anxiety Scale, SAD: Social anxiety disorder, STAI: State-Trait Anxiety Inventory
[a]Data expressed as mean – standard deviation, [b]Student's ŧ-test, [c]Ch -Square test, [d]Mann-Whitney U test.

tically higher than the control group (p<0.001, Cohen's d =1.33, and p<0.001, Cohen's d =1.42, respectively) (Table 1).

The BIS-15 total scores (p<0.001, Cohen's d=0.81) BIS-15np (p<0.001, Cohen's d=0.66), BIS-15m (p<0.001, Cohen's d=0.72), and BIS-15a (p<0.001, Cohen's d=0.83) for SAD were higher than the HCs. Risk-taking behavior was defined as the total number of cards taken from advantageous and disadvantageous decks for each block. According to this, the IGT-total score, IGT-1, IGT-2, IGT-3, and IGT-4 performance of the SAD group was similar to the HCs. The IGT-5 score performance of the HC group was significantly worse than the SAD group (p=0.34, Cohen's d= 0.19). However, when the education, age, depression, and anxiety scores of the patient and control groups were fixed and their IGT scores were compared, no difference was found according to the Quades ANCOVA analysis (Table 1), (Fig 1).

Generalized type versus nongeneralized type

The comparison of sociodemographic data and test scores of patients with generalized type and non-generalized type SAD is shown in Table 2. There was no statistically significant difference between subtypes in terms of age (p=0.219), sex (p=0.078), duration of education (p=0.286), and comorbidities (p=0.091). There was no significant difference between STAI-trait, BIS-15-total score, and subscales between the generalized type and the non-generalized type. Although there was no significant difference between the two types concerning impulsivity, the nongeneralized type had higher impulsivity scores. BDI, STAI-state, LSAS-anxiety and LSAS-avoidance scores were significantly higher in the generalized type than in the nongenera-

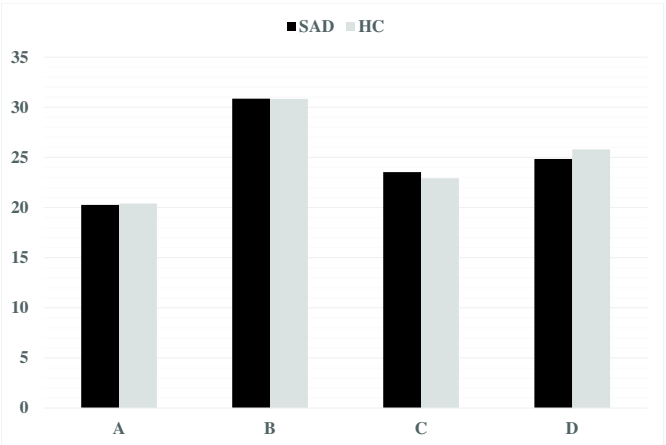

Fig.1. The Total Advantageous (C and D) and Disadvantageous (A and B) card selection in Social anxiety disorder (SAD), and healthy controls (HC).

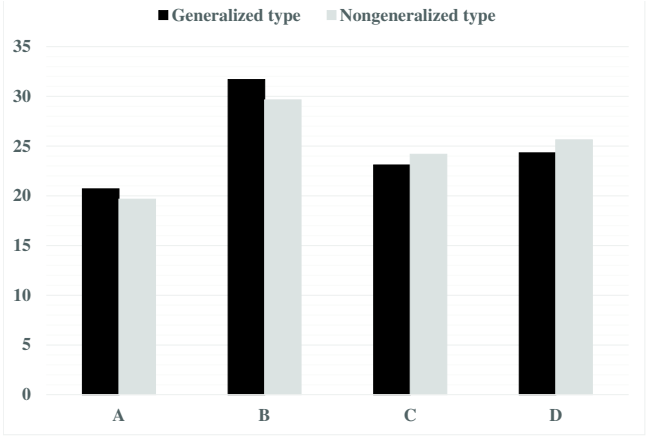

Fig.2. The Total Advantageous (C and D) and Disadvantageous (A and B) card selection in the generalized type, and the nongeneralized type

Table 2. Comparison of subtypes of SAD

					ANCOVA		
Variables	Generalized (n=47)[a]	Nongeneralized (n=32)[a]	t, Z, x†	p value	F	p value	n2
Age (yr)	24.1–5.4	25.8–6.9	1[b]	0,219			
Sex (Female), n (%)	17(36.2)	18(56.2)	3,111[c]	0,078			
Education (yr)	14.2–2.8	14.9–2.2	-1,068[d]	0,286			
Comorbidity, n (%)	35(14.5)	18(56.2)	2,862[c]	0,091			
BDI scale scores	24.5–11.6	16.1–12.1	-3.095[b]	0,003			
STAI-1 (state)	48.9–11.2	43.2–10.6	-2.290[b]	0,025			
STAI-2 (trait)	57.9–11.6	52.8–11.6	-1.937[b]	0,056			
LSAS-fear	64.4–14.6	51.5–12.9	-4.050[b]	<0.001			
LSAS-avoidance	60.9–14.7	46.5–13.3	-4.438[b]	<0.001			
BIS-15np	10.9–2.9	11.2–3.3	-0.463[d]	0,643			
BIS-15m	10.6–2.8	11–3.5	0,591[b]	0,556			
BIS-15a	10.3–3.3	11.2–3.7	1,095[b]	0,277			
BIS-15total score	31.8–7.7	33.4–9.4	0,845[b]	0,401			
IGT-1 (1-20)	-1.5–4.8	-2.4–3.9	-0.698[d]	0,485	2,237	0,139	0,028
IGT-2 (21-40)	-0.8–4.3	0.06–4	0,948[b]	0,346	0,641	0,426	0,009
IGT-3 (41-60)	-0.6–4.1	0.7–4.9	1,252[b]	0,214	1,79	0,185	0,024
IGT-4 (61-80)	-1–5.4	0.4–4.5	-1.645[d]	0,1	3,599	0,062	0,045
IGT-5 (81-100)	0.2–5.7	2.2–7.3	1,374[b]	0,174	1,989	0,163	0,027
IGT-total score (1-100)	-4.6–14.7	1.7–14.8	2[b]	0,067	4,731	0,033	0,061

Abbreviations: BDI: Beck depression inventory scale, BSIa: Barratt Impulsiveness Scale-Short Form- attentional impulsivity, BIS-15m: motor impulsivity,BIS-15np: non-planning, IGT: Iowa Gambling Test,Hc: Healthy control,LSAS: Liebowitz Social Anxiety Scale, SAD: Social anxiety disorder, STAI: State-Trait Anxiety Inventory

[a]Data expressed as mean – standard deviation, [b]Student's ŧ-test, [c]Ch -Square test, [d]Mann-Whitney U test.

lized type (p=0.03, Cohen's d =0.80, p=0.025, Cohen's d =0.53, p<0.001, Cohen's d =0.94 and, p<0.001, Cohen's d =1.04, respectively). There was no significant difference in IGT-total score and sub-blocks between the generalized type and the nongeneralized type. However, the IGT-total score was significantly lower in patients with generalized type SAD in the ANOVA analysis when depression, anxiety, age, and education were controlled for (p=0.033, Cohen's d =-0.43) (Table 2), (Fig1,2).

In the generalized type, only Barratt-total and IGT-5 were significantly negatively correlated (r=-0.306; p<0.05). There was no significant correlation between Barrat's subscales and LSAS subscales and the IGT. In the nongeneralized type, only BIS-15a, and IGT-2 were significantly negatively correlated (r= -0.400, p<0.005). There was no significant correlation between the others.

DISCUSSION

In this study, we compared risk-taking and decision-making performance in patients with SAD under ambiguous situations with HCs. One of the main results of this study is that the decision-making performance of patients with SAD under uncertainty was similar to that of the HCs. Patients with SAD preferred advantageous decks like HC parti-cipants and learned to avoid disadvantageous decks (see Fig 3).

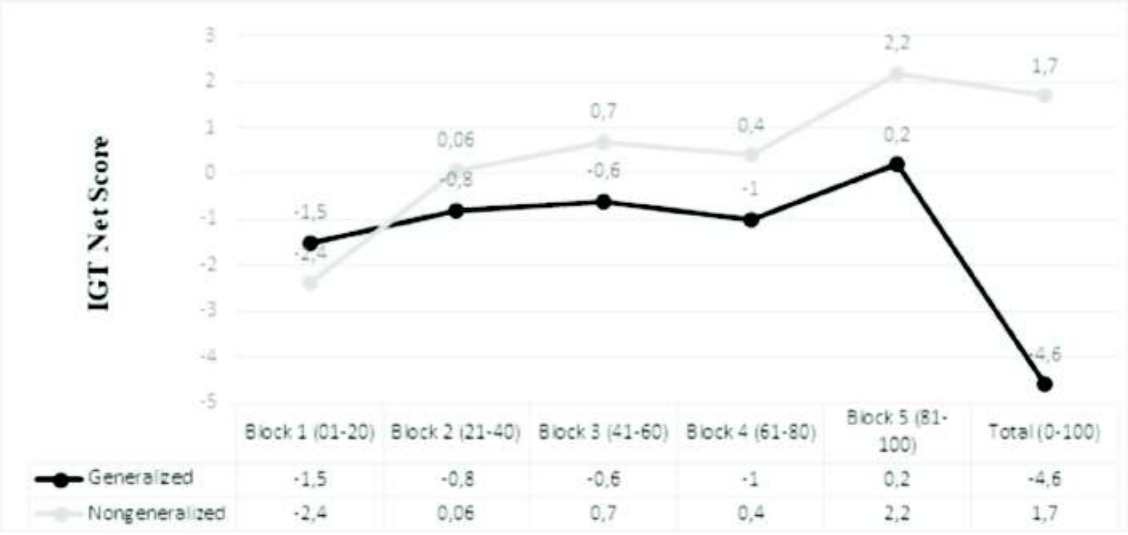

Fig.3: Decision-making between generalized and nongeneralized types. The mean net number of chosen cards (C+D) –(A+B) by generalized and nongeneralized types, across five blocks each consisting of 20 trials. Positive net scores reflect advantageous decision-making performance, while negative net scores reflect disadvantageous decision-making performance.

Somatic markers are regulated in the emotional circuits of the brain, specifically, in the ventromedial prefrontal cortex (vmPFC), and are suggested to aid decision-making in ambiguous situations (21,25). In ambiguous situations, somatic markers work like automatic alarms, marking available response options with an emotional signal (25). These auto-alarms enable accurate decision-making from fewer options (22). Somatic cues of good or bad choices enable people to make and maintain useful decisions (21). From this point of view, it can be argued that patients with SAD can develop somatic markers in this task.

It is noteworthy that patients with SAD outperformed healthy controls in the "conceptual" period (block 5) when the participants understood the reward/punishment differences between the IGT bundles and reached a fully conscious knowledge of the content of the task. This finding shows that patients with SAD comprehended the content of the task towards the end of the test and turned to advantageous decks. However, the same finding was not observed in healthy participants. During the IGT, as healthy participants learn the approximate frequency and magnitude of reward and punishment through trial and error, participants are expected to direct their preference to advantageous cards (52). In the IGT task, healthy participants were found to perform poorly (53). Normal adults who describe themselves as risk takers make more choices from disadvantaged decks than advantageous decks (20). The reason for the low performance of healthy participants during the IGT was explained by reasons such as excitement seeking, disinhibition, impulsivity, and lack of motivation (53–55). While stress encourages risk taking in individuals with low social anxiety, it causes risk aversion in individuals with high social anxiety (35). High negative affect was associated with greater avoidance of high loss decks, and high positive affect was associated with more selection than high gain decks (56). In addition, individuals with high trait anxiety were found to be associated with impaired decision making in IGT (57). Individuals with different trait anxiety may react in a certain way under stress and may differ from each other in their initial decision-making performance (57,58). The lack of difference between the patient group and the control group in our study may be due to the robust decision-making ability of patients with SAD or the poor performance of the HCs.

We found some important differences in decision-making strategies under ambiguous situations according to clinical subtypes of SAD. Patients with generalized-type SAD made more choices from disadvantaged and risky decks. They were more sensitive to immediate rewards rather than long-term gains, and their choice resulted in a net loss. The patients with the nongeneralized type, on the other hand, chose more advantageous packs in the long run, winning less and losing less, and their selections resulted in net profits. The decision-making behavior of patients with the generalized type can be thought of as taking immediate comforting action, such as avoiding, instead of thinking about the long-term disadvantageous consequences of avoidance, as in real life. In other words, the avoidance behavior of patients with common-type SAD can also be interpreted as not being able to make a long-term profit-loss analysis correctly because when their strategy in the task is a choice that will bring immediate reward, they make that choice and ignore future possibilities (Fig 2).

Poor performance in the IGT has also been associated with reverse learning (17,25) because disadvantageous decks (A and B) are clearly associated with higher payoffs at the start of the task. After a few tries, participants should learn that these decks are at a disadvantage because they lead to losses in the long run (17). Accordingly, successful performance in the IGT typically involves moving from risky decks to less risky decks that initially seem rewarding but are gradually associated with greater penalties (16). From this point of view, it can be said that the generalized type has weak reverse learning skills under uncertain situations.

To see the increasing learning effect of both subtypes in the gambling task, when the block net scores throughout the 5 blocks were examined, it was seen that the scores of the nongeneralized type increased above 0 from block 1. The nongeneralized type increased their performance by choosing more advantageous decks after the first 20 card selections and managed to show a learning effect. By contrast, the generalized type showed a learning effect only in the fifth block and continued to choose from disadvantageous cards in the other blocks. It is thought that a successful decision-making performance is related to different cognitive functions such as evaluating the loss-gain possibili-

ties, making profit-loss analysis, keeping the decision in memory in the previous election, and using the feedback obtained after the elections (59). From this point of view, it is thought that the generalized type group could not benefit from feedback and did not have a learning effect (see Fig 3).

Patients with generalized type SAD were found to show more anxiety, poorer skills, and less positive thinking during behavioral tests (13,60). It was found that patients with the nongeneralized type showed more anticipatory anxiety and higher heart rate than the common type and controls in behavioral tests (13). In another study, the nongeneralized type showed a higher heart rate during behavioral testing than the generalized type (60). SMH, claims that somatic activation secretly drives decision-making (22). Skin conductivity responses such as heart rate and muscle tension are some of these somatic cues. According to this hypothesis, every behavioral possibility is associated with unconscious somatic responses evoked by its previous consequences (61). Somatic states evoked by emotions are associated with positive or negative outcomes, then reactivate this state through the somatosensory cortex, influencing decision-making (23). Impairments in this task in patients with generalized-type SAD may be related to an impairment in somatic activation.

SMH suggests that impairment in emotions and feelings negatively affects decision-making (21) because, in ambiguous situations, somatic markers are assumed to mark possible options with an emotional signal about the good or bad of the associated outcome (53). Studies have shown that patients with the common subtype and early-onset SAD exhibit more severe symptoms and greater behavioral inhibition (62). It has been found that patients with SAD of the generalized type are more sensitive to environmental threats, do not seek novelty, and show more behavioral inhibition than those with the nongeneralized type (63). Binelli et al. examined a group of patients with high social anxiety levels as harm avoidant, a low novelty-seeking cluster, and a novelty-seeking impulsive cluster. It was observed that the majority of the people in the first group showed behavioral suppression, tried to control themselves excessively, and avoided taking risks, whereas the other group was prone to risk-taking, and exhibited impulsive and aggressive behaviors (64). In a study conducted by Kashdan and Hofmann in 2008, patients with the generalized type of SAD were examined in two different subgroups, low novelty seeking and high novelty seeking. The first group was characterized by social anxiety and avoidance and low novelty seeking, and the second group was characterized by high novelty seeking tendencies. In this group, it was stated that there may be impulsive decision-making behavior in parallel with difficulty in emotion regulation, novelty seeking, and risk proneness (65). There are also criticisms suggesting that SAD should be seen as a continuum of severity, and that when social anxiety is controlled, the differences between subtypes disappear (66). We think that the findings in the decision-making processes of the subtypes in our study can contribute to the current discussions.

An interesting finding of our study was that there was a significant negative correlation between Barratt-total and IGT-5 in patients with generalized type. It may be possible to interpret this finding in the following way. Bechara et al. reached the following results in a study they conducted on the process of choosing from advantageous decks. Regardless of whether the participants chose from the A and B decks after the first 10 card selections, they defined this period as the pre-punishment period because they did not face any punishments. The pre-hunch period is when participants have yet to grasp the content of the task, choosing cards from the A or B decks and facing a few penal sanctions. When healthy participants can develop an idea that decks A and B are riskier when approaching about 50 cards, this has been described as the hunch period. The conceptual period is defined as when healthy participants consciously reach full knowledge of what is going on in the content of the task as they approach about 80 cards (50). It can be concluded in our study that the generalized type reached the conceptual period, becoming aware that something was wrong. They realized that they should not avoid social situations. However, high impulsivity can cause them to make disadvantageous decisions despite the knowledge that something is wrong.

The most important limitation of our study is the high rate of comorbidities in patients with SAD.

Studies show that there is a high rate of comorbid diagnoses in patients with SAD (67,68). Another limitation of our study is the low mean age of both the patient and healthy control groups. We can recommend repeating the study in a wider age range. Finally, the fact that we did not look at skin conductivity during the task can be considered another limitation. For both high and low trait anxiety, skin conductance responses before choosing advantageous cards were found to predict IGT performance (57). Future studies that evaluate decision-making along with skin conductivity to elucidate the effect of somatic markers on decision-making processes in patients with SAD and their subtypes may lead to further enlightenment.

CONCLUSION

In conclusion, according to the findings of our study, decision-making performance in patients with SAD is similar to that of healthy controls. The ability to make decisions under uncertainty of patients with the generalized subtype was found to be impaired compared with those with the non-generalized subtype. This suggests that the deterioration in the generalized subtype may be related to the short-term winning but long-term losing choices and the inability to benefit from feedback. We believe that this differentiation in the decision-making processes of SAD subtypes will contribute to a better understanding of generalized and non-generalized subgroups.

Acknowledgments

The authors are grateful to the patients with SAD and the healthy volunteers who participated in this study.

Conflict of Interest

The authors declare that they have no conflicts of interest.

Ethical Publication Statement

We confirm that we have read the Journal's position on issues involved in ethical publication and affirm that this report is consistent with those guidelines.

Correspondence address: Assis. Prof. Hasan Demirci, Department of Psychology, University of Health Sciences, Istanbul, Turkey pskhasandemirci@gmail.com

REFERENCES

1. Stein MB, Stein DJ. Social anxiety disorder. The Lancet. 2008;371:1115–25.

2. Wittchen HU, Fehm L. Epidemiology and natural course of social fears and social phobia. Acta Psychiatr Scand. 2003;108:4–18.

3. Wittchen HU, Fuetsch M, Sonntag H, Müller N, Liebowitz M. Disability and quality of life in pure and comorbid social phobia. Findings from a controlled study. European Pschiatry. 2000;15:46– 58.

4. Wittchen HU, Fehm L. Epidemiology, patterns of comorbidity, and associated disabilities of social phobia. Psychiatric Clinics. 2001; 24: 617-641.

5. Joseph Bienvenu O, Hettema JM, Neale MC, Prescott CA, Kendler KS. Low extraversion and high neuroticism as indices of genetic and environmental risk for social phobia, agoraphobia, and animal phobia. Am J Psychiatry. 2007;164:1714–1721.

6. Lieb R, Wittchen HU, Höfler M, Fuetsch M, Stein MB, Merikangas KR. Parental psychopathology, parenting styles, and the risk of social phobia in offspring: a prospective-longitudinal community study. Arch Gen Psychiatry. 2000 Sep;57(9):859-66. doi: 10.1001/archpsyc.57.9.859. PMID: 10986549.

7. Hudson JL, Rapee RM. The origins of social phobia. Behavior Modification . 2000;24(1):102– 129.

8. Furmark T, Tillfors M, Everz PO, Marteinsdottir I, Gefvert O, Fredrikson M. Social phobia in the general population: prevalence and sociodemographic profile. Soc Psychiatry Psychiatr Epidemiol. 1999;34:416–24.

9. Furmark T. Social phobia: Overview of community surveys. Acta Psychiatr Scand.2002;105:84 93.

10. Freitas-Ferrari MC, Hallak JE, Trzesniak C, Filho AS, Machado-de-Sousa JP, Chagas MH, Nardi AE, Crippa JA. Neuroimaging in social anxiety disorder: a systematic review of the literature. Prog Neuropsychopharmacol Biol Psychiatry. 2010 May 30;34(4):565-80. doi: 10.1016/j.pnpbp.2010.02.028. Epub 2010 Mar 4. PMID: 20206659.

11. Eldoğan D. Sosyal anksiyete bozukluğunun alt tipleri: Heterojen bir tanı kategorisi. Psikiyatride Guncel Yaklasimlar. 2018;30:202–217.

12. Heimberg RG, Holt CS, Schneier FR, Spit-Zer RL, Liebowitz MRMD. The issue of subtypes in the social phobia diagnosis. J Anxiety Disord. 1993;7: 249-269.

13. Boone ML, Mcneil DW, Masia CL, Turk CL, Carter LE, Ries BJ, et al. Multimodal comparisons of social phobia subtypes and avoidant personality disorder. J Anxiety Disord. 1999; 13: 271-292

14. Stein MB, Chartier MJ, Hazen AL, Kozak MV, Tancer ME, Lander S, Furer P, Chubaty D, Walker JR. A direct-interview family study of generalized social phobia. Am J Psychiatry. 1998 Jan;155(1):90-7. doi: 10.1176/ajp.155.1.90. PMID: 9433344.

15. Fyer AJ, Mannuzza S, Chapman TF, Liebowitz MR, Klein DF. A direct interview family study of social phobia. Archives of General psychiatry. 1993;50: 286-293

16. Clark L, Cools R, Robbins TW. The neuropsychology of ventral prefrontal cortex: Decision- making and reversal learning. Brain and cognition. 2004;55:41–53.

17. Brand M, Labudda K, Markowitsch HJ. Neuropsychological correlates of decision-making in ambiguous and risky situations. Neural Networks. 2006;19(8):1266–1276.

18. Bechara A. The role of emotion in decision-making: Evidence from neurological patients with orbitofrontal damage. Brain Cogn. 2004;55(1):30–40.

19. Bechara A, Damasio AR, Damasio H, Anderson SW. Insensitivity to future consequences following damage to human prefrontal cortex. Cognition. 1994;50:7–15.

20. Bechara A, Tranel D, Damasio H. Characterization of the decision-making deficit of patients with ventromedial prefrontal cortex lesions. Brain. 2000;123:2189–2020.

21. Bechara A, Damasio H, Damasio AR. Emotion, decision making and the orbitofrontal cortex. Cerebral Cortex. 2000;10:295–307.

22. Damasio R.Antonio. Descartes' Error: Emotion, Reason, and the Human Brain. New York: Grosset/Putman; 1994.

23. Damasio AR. The somatic marker hypothesis and the possible functions of the prefrontal cortex. Philosophical Transactions of the Royal Society B: Biological Sciences. 1996;351:1413–1420.

24. Naqvi N, Shiv B, Bechara A. The role of emotion in decision making: A cognitive neuroscience perspective. Curr Dir Psychol Sci. 2006;15:260–264.

25. Dunn BD, Dalgleish T, Lawrence AD. The somatic marker hypothesis: A critical evaluation. Neurosci Biobehav Rev. 2006;30; 239–271.

26. Demirci H, Pirdoğan E, Güler J, Ozer Ö, Oğuz K. Decision-making performance in Trichotillomania and skin picking disorder. J Obsessive Compuls Relat Disord. 2021;31.100688

27. Christodoulou T, Lewis M, Ploubidis GB, Frangou S. The relationship of impulsivity to response inhibition and decision-making in remitted patients with bipolar disorder. European Psychiatry. 2006;21:270–273.

28. Bark R, Dieckmann S, Bogerts B, Northoff G. Deficit in decision making in catatonic schizophrenia: An exploratory study. Psychiatry Res. 2005;15:131–141.

29. Petry NM. Substance abuse, pathological gambling, and impulsiveness. Drug Alcohol Depend. 2001;63:29–38.

30. Lee Y, Kim YT, Seo E, Park O, Jeong SH, Kim SH, Lee SJ. Dissociation of emotional decision-making from cognitive decision-making in chronic schizophrenia. Psychiatry Res. 2007 Aug 30;152(2-3):113-20. doi: 10.1016/j.psychres.2006.02.001. Epub 2007 Apr 25. PMID: 17462743.

31. Cavedini P, Zorzi C, Baraldi C, Patrini S, Salomoni G, Bellodi L, Freire RC, Perna G. The somatic marker affecting decisional processes in obsessive-compulsive disorder. Cogn Neuropsychiatry. 2012;17(2):177-90. doi: 10.1080/13546805.2011.614152. Epub 2011 Oct 12. PMID: 21991936.

32. Garrido I, Subirá S. Decision-making and impulsivity in eating disorder patients. Psychiatry Res. 2013;207:107–112.

33. Toplak ME, Jain U, Tannock R. Executive and motivational processes in adolescents with Attention-Deficit-Hyperactivity Disorder (ADHD). Behavioral and Brain Functions. 2005;1:1-12

34. Delibaş DH, Akseki HS, Erdoğan E, Zorlu N, Gülseren Ş. Impulsivity, sensation seeking, and decision-making in long-term abstinent cannabis dependent patients. Noropsikiyatri Arsivi. 2018;55:315–319.

35. Hengen KM, Alpers GW. Stress makes the difference: Social stress and social anxiety in decision-making under uncertainty. Front Psychol. 2021;12:578293.

36. Pittig A, Pawlikowski M, Craske MG, Alpers GW. Avoidant decision making in social anxiety: The interaction of angry faces and emotional responses. Front Psychol. 2014;5:1050

37. Pittig A, Alpers GW, Niles AN, Craske MG. Avoidant decision-making in social anxiety disorder: A laboratory task linked to in vivo anxiety and treatment outcome. Behaviour Research and Therapy. 2015;73:96–103.

38. Bechara A, Damasio H, Damasio AR. Role of the amygdala in decision-making. Ann N Y Acad Sci. 2003;985:356–369.

39. Bechara A, Damasio H, Damasio AR, Lee GP. Different contributions of the human amygdala and ventromedial prefrontal cortex to decision-making. Journal of Neuroscience. 1999;19:5473–5481. .

40. Stein MB, Torgrud LJ, Walker JR. Social phobia symptoms, subtypes, and severity. Arch Gen Psychiatry. 2000;57:1046-1052

41. First MB. Structured clinical interview for the DSM (SCID). The Encyclopedia of Clinical Psychology. 1st ed. American Psiychiatric Pub; 2015. 1–6 p.

42. Elbir M, Alp Topbaş Ö, Bayad S, Kocabaş T, Topak OZ, Çetin Ş, Özdel O, Ateşçi F, Aydemir Ö. DSM-5 Bozuklukları için Yapılandırılmış Klinik Görüşmenin Klinisyen Versiyonunun Türkçeye Uyarlanması ve Güvenilirlik Çalışması [Adaptation and Reliability of the Structured Clinical Interview for DSM-5-Disorders - Clinician Version (SCID-5/CV) to the Turkish Language]. Turk Psikiyatri Derg. 2019 Spring;30(1):51-56. Turkish. PMID: 31170307.

43. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An Inventory for Measuring Depression. Arch Gen Psychiatry. 1961;4:561–571.

44. Hisli N. Beck Depresyon Envanterinin üniversite öğrencileri için geçerlilik ve güvenilirliği.Türk Psikoloji Dergisi. 1989;7:3-13.

45. Spielberger CD GRLR. Manual for State-Trait Anxiety Inventory. Paulo Alto, California: Consulting Psychologists Press; 1970.

46. Öner N, LeCompte A. Durumsal-Sürekli Kaygı Envanteri El Kitabı. 2nd ed. İstanbul: Boğaziçi Üniversitesi Matbaası; 1985.

47. Heimberg RG, Horner KJ, Juster HR, Safren SA, Brown EJ, Schneier FR, Liebowitz MR. Psychometric properties of the Liebowitz Social Anxiety Scale. Psychol Med. 1999 Jan;29(1):199-212. doi: 10.1017/s0033291798007879. PMID: 10077308.

48. Soykan Ç, Özgüven Devrimci H, Gençöz T. Liebowitz Social Anxiety Scale: The Turkish Versiyon. Psychol Rep. 2003;93:1059-1069.

49. Tamam L, Güleç H, Karataş G. Barratt Dürtüsellik Ölçeği Kısa Formu. Nöropsikiyatri Arşivi. 2013;50:130–134.

50. Bechara A, Damasio H, Tranel D, Damasio AR. Deciding advantageously before knowing the advantageous strategy. Science.1997;275:1293–1295.

51. Içellioğlu S. Iowa Kumar Testi: Normatif veriler ve yürütücü işlevlerle ilişkisi. Dusunen Adam. 2015;28:222–230.

52. Bull PN, Tippett LJ, Addis DR. Decision making in healthy participants on the Iowa Gambling Task: New insights from an operant approach. Front Psychol. 2015;6.391

53. Steingroever H, Wetzels R, Horstmann A, Neumann J, Wagenmakers EJ. Performance of healthy participants on the Iowa Gambling Task. Psychol Assess. 2013;25:180–193.

54. Overman WH, Pierce A. Iowa Gambling Task with non-clinical participants: Effects of using real + virtual cards and additional trials. Front Psychol. 2013;4:935

55. Perales JC, Verdejo-Garcia A, Moya M, Lozano Ó, Pérez-Garcia M. Bright and dark sides of impulsivity: Performance of women with high and low trait impulsivity on neuropsychological tasks. J Clin Exp Neuropsychol. 2009;31:927–944.

56. Peters E, Slovic P. The springs of action: Affective and analytical information processing in choice. Pers Soc Psychol Bull. 2000 ;26:1465–1475.

57. Miu AC, Heilman RM, Houser D. Anxiety impairs decision-making: Psychophysiological evidence from an Iowa Gambling Task. Biol Psychol. 2008;77:353–358.

58. Starcke K, Brand M. Decision making under stress: A selective review. Neurosci Biobehav Rev. 2012;36:1228–1248.

59. van Duijvenvoorde ACK, Jansen BRJ, Bredman JC, Huizenga HM. Age-related changes in decision making: Comparing informed and noninformed situations. Dev Psychol. 2012;48:192–203.

60. Heimberg RG, Hope DA, Dodge CS, Becker RE. DSM-III-R subtypes of social phobia. Comparison of generalized social phobics and public speaking phobics. J Nerv Ment Dis. 1990;3:172–179.

61. Suzuki A, Hirota A, Takasawa N, Shigemasu K. Application of the somatic marker hypothesis to individual differences in decision making. Biol Psychol. 2003;65:81–88.

62. Lim SW, Ha J, Shin YC, Shin DW, Bae SM, Oh KS. Clinical differences between early- and late-onset social anxiety disorders. Early Interv Psychiatry. 2013:44–50.

63. Hofmann SG, Bitran S. Sensory-processing sensitivity in social anxiety disorder: Relationship to harm avoidance and diagnostic subtypes. J Anxiety Disord. 2007;21:944–954.

64. Binelli C, Muñiz A, Sanches S, Ortiz A, Navines R, Egmond E, et al. New evidence of heterogeneity in social anxiety disorder: Defining two qualitatively different personality profiles taking into account clinical, environmental and genetic factors. European Psychiatry. 2015;30:160–165.

65. Kashdan TB, Hofmann SG. The high-novelty-seeking, impulsive subtype of generalized social anxiety disorder. Depress Anxiety. 2008;25:535–541

66. Aderka IM, Nickerson A, Hofmann SG. Admixture analysis of the diagnostic subtypes of social anxiety disorder: Implications for the DSM-V. J Behav Ther Exp Psychiatry. 2012;43:752–757.

67. Mennin DS, Heimberg RG, Jack MS. Comorbid generalized anxiety disorder in primary social phobia: Symptom severity, functional impairment, and treatment response. J Anxiety Disord. 2000;14:325–343.

68. Merikangas KR, Angst J. Comorbidity and social phobia: evidence from clinical, epidemiologic, and genetic studies. Eur Arch Psychiatry Clin Neurosci. 1995;244:297–303.