NÖRO PSİKİYATRİ ARŞİVİ
ARCHIVES OF NEUROPSYCHIATRY

RESEARCH ARTICLE

Arch Neuropsychiatry 2021;58:234–241
https://doi.org/10.29399/npa.27369

Study of Validity and Reliability of the Reinforcement Sensitivity Questionnaire in Turkish Community Sample

Gülşah BALABAN[1], **Yusuf BİLGE**[2]

[1]İstanbul Sabahattin Zaim University, Graduate Education Institute, Department of Psychology, İstanbul, Turkey
[2]İstanbul Sabahattin Zaim University, Faculty of Humanities and Social Sciences, Department of Psychology, İstanbul, Turkey

ABSTRACT

Introduction: In this study, it is aimed to assess the validity and reliability of Reinforcement Sensitivity Questionnaire (RSQ) which was developed on the basis of revised Reinforcement Sensitivity Theory (rRST) in Turkish community sample.

Methods: The sample of study was consisted of 528 participants, 314 (59.5%) female and 214 (40.5%) male, in the range of 18-69 years. Data was collected by using online data collection tools via snowball method. Within the scope of the reliability study, test-retest application, split-half method and internal consistency analysis; within the scope of the validity study, explanatory factor analysis and confirmatory factor analysis were performed. For criterion-related validity Behavioral Inhibition System / Behavioral Activation System Scale (BIS/BAS), Eysenck Personality Questionnaire Revised-Abbreviated Form (EPQR-A) and State-Trait Anxiety Inventory (STAI-II) were applied.

Results: At the result of reliability analysis, the Cronbach Alpha internal consistency coefficient values of RSQ subscales were determined between 0.71 and 0.82. At the result of criterion-related validity, statistically significant correlations between subscales of RSQ and the similar subscales of BIS/BAS, EPQR-A and STAI-II were found. In explanatory factor analysis, a five-factor construct that has eigenvalues above 1, accounting for 49.96% of the total variance was found and it was seen that the questionnaire items loaded on their expected subscales consistent with the original questionnaire. In confirmatory factor analysis, CFI value was below the acceptable value of 0.90 at the first analysis. After eliminating two items and applying the recommended modifications, the fit indices reached the acceptable levels.

Conclusion: According to the results of analysis, it was determined that Turkish version of RSQ is a valid and reliable evaluation tool for Turkish population.

Keywords: Reinforcement Sensitivity Questionnaire, Reinforcement Sensitivity Theory, BIS, BAS, fight/flight/freeze system

Cite this article as: Balaban G, Bilge Y. Study of Validity and Reliability of the Reinforcement Sensitivity Questionnaire in Turkish Community Sample. Arch Neuropsychiatry 2021;58:234-241.

INTRODUCTION

Gray (2) defined three systems as Behavioral Activation System (BAS), Behavioral Inhibition System (BIS) and Fight-Flight System (FFS) in his neurobiologically-based personality theory on the basis of the claim that there is a relationship between sensitivity to reward and punishment and the personality types of introversion and extroversion defined by Eysenck (1). BAS is associated with extraversion which is related to impulsivity and sensitivity to reward; BIS is associated with introversion which is related to anxiety and sensitivity to punishment; FFS is associated with psychoticism which is related to sensitivity to unconditioned aversive stimulus. It is stated that the biological basis of these systems are mesolimbic dopaminergic pathways for BAS; brain stem and septo-hippocampal pathway for BIS (3). According to Gray, hyperactivation in the BIS and BAS systems are the effective factors in the development of psychopathology. Studies have shown that BIS is associated with anxiety disorders (4) and obsessive-compulsive disorder (5), while BAS is associated with externalizing disorders such as hyperactivity and aggression and also bulimia nervosa (6). In addition, in the study done by Segarra et al. (7), it was determined that clinical subscales in MMPI-2 were associated with BIS and BAS. In this study, a positive correlation was found between BIS and hypochondria, hysteria, paranoia, psychasthenia, depression and social introversion; between BAS and psychotic deviation and schizophrenia a positive correlation was also determined.

Gray and McNaughton (8), then revised the Reinforcement Sensitivity Theory (RST) which was developed by Gray, depending on the studies done in this field. In this revision, a third sub-dimension entitled as 'Freeze' has been added to the Fight-Fight System. In addition to this, the Fight-Flight-Freeze System (FFFS) has been associated with sensitivity to not only unconditioned aversive stimulus but also all conditioned and inherited aversive stimulus.

It is seen that the most important revision in the new theory is in the distinction between BIS and FFFS. It was explained that FFFS has a relation with fear, BIS has a relation with anxiety. When the neurobiological basis and connections of these systems are examined, it is seen that they are related to parallel and symmetrical hierarchical structures in the brain. In FFFS, beginning from the prefrontal-ventral pathway, the anterior cingulate, amygdala, medial hypothalamus and finally the periaqueductal gray area are activated depending on the distance of the threatening object. In BIS, a hierarchical activation is observed beginning from the

Correspondence Address: Gülşah Balaban, İstanbul Sabahattin Zaim Üniversitesi, Halkalı Kampüsü, 34303 Küçükçekmece, İstanbul, Turkey • **E-mail:** sahquant@gmail.com
Received: 07.08.2020, **Accepted:** 28.12.2020, **Available Online Date:** 26.08.2021

prefrontal dorsal pathway, posterior cingulate, septo-hippocampal system, amygdala, medial hypothalamus and periaqueductal gray region. According to these, it is claimed that there is a two-dimensional defence system (9). If the threatening object is far enough to be avoided, the flight behavior occurs related to FFFS, but if it is too close not to be able to escape, a fight or freeze response occurs. On the other hand, in case of activation of BIS, a risk assessment is carried out and this results in a nervous expectation in the last situation when the threatening object is too close not to be able to escape from it (10).

The distinction between BIS and FFFS systems is also supported by pharmacological studies. In the literature, there are studies showing that anxiolytic drugs are effective in generalized anxiety disorder, which is known to be associated with BIS, but that the same type of drugs are not effective in panic disorder which is associated with FFFS (8). The fact that anxiolytic drugs are effective in behavior patterns that occur in the cases of approach-avoidance conflict associated with BIS, but have no effect on active avoidance behaviors associated with FFFS, provides supportive information in the distinction between these systems (10).

In the revised RST (rRST), there is also a functional difference in the definition of BIS as different from the original theory. According to the rRST, BIS plays a role in determining the approach or avoidance behavior in the face of a possible threat by carrying out a risk assessment in the situations of approach-avoidance, approach-approach and avoidance-avoidance conflicts which occur due to the approach of danger or presence of reward and punishment simultaneously (8).

In the literature, it is seen that there are different questionnaires developed based on Gray's RST theory. The Behavioral Inhibition System/Behavioral Activation System Scale (BIS/BAS) (11) and the Sensitivity to Punishment / Sensitivity to Reward Questionnaire (SPSRQ) (12) were prepared according to the original RST theory and are the most widely used questionnaires in this field (13). The questionnaires which were developed according to the rRST are as follows: Jackson 5 (J5) (14), Reinforcement Sensitivity Theory of Personality Questionnaire (RST-PQ) (15), Reinforcement Sensitivity Questionnaire (RSQ) (16), Reuter and Montag rRST-Q (17), Fight, Flight, Freeze Questionnaire (FFFQ) (18), Sensitivity to Punishment / Sensitivity to Reward Questionnaire for Children (SPSRQ-C) (19). When the questionnaires developed based on the rRST are examined, it is seen that the FFFQ questionnaire deals with only sub-dimensions of FFFS. In the SPSRQ-C questionnaire, the sensitivity of reward and punishment in children is evaluated according to the reports of caregivers. In the Jackson 5 questionnaire, five dimensions (BAS, BIS, Fight, Flight, Freeze) are evaluated separately, but the conformity of the features evaluated in it to rRST is controversial. Although the Jackson 5 questionnaire seems to be one of the most suitable questionnaires for rRST structurally, it is criticized that the items in the BIS subscale generally have a competitive content such as comparing oneself with others, so as the items in BIS do not evaluate conflict situations (16). In the RST-PQ questionnaire, while the BAS dimension is evaluated in detail, it is seen that no distinction is made between the Fight-Flight-Freeze dimensions. On the other hand, the Reinforcement Sensitivity Questionnaire developed by Smederevac et al. (16), is differentiated from other questionnaires as it evaluates the properties of the five dimensions (BAS, BIS, Fight, Flight, Freeze) defined in the rRST separately in accordance with the theory. When the Turkish literature is examined, although RST has been the topic of many studies in the field of personality for many years, it is seen that only the BIS/BAS scale has been translated into our language and its psychometric properties are made in university students (20). At this point, considering that there is a need for an up-to-date measurement tool to evaluate the motivational systems which are included in rRST that has been examined in many studies to understand the personality and psychopathology as mentioned above, in this study it was aimed to perform the study of validity and reliability of Turkish version of Reinforcement Sensitivity Questionnaire (RSQ) developed by Smederevac et al. (16) in accordance with rRST.

METHODS

Participants

The sample of this study, which was held between the dates 04.07.2020-11.07.2020, consists of a total 528 participants between the ages of 18-69 (30,81±10,45) as 314 women (59,5%) and 214 men (40,5%) that were reached online by snowball method in accordance with convenience method. 23 (4.4%) of the participants are primary school graduates, 68 (12.9%) are high school graduates, 437 (82.8%) are university graduates; 297 (56.3%) are single, 219 (41.5%) are married, 8 (1.5%) are divorced, and 4 (0.8%) are widows. In terms of perceived socioeconomic status, 39 (7.4%) were low, 457 (86.6%) were medium, and 32 (6.1%) were high. 70 (13.3%) of the participants reported that they are currently receiving psychological or psychiatric help, 458 (86.7%) reported that they are not currently receiving psychological or psychiatric help; 197 (37.3%) stated that they felt the need for psychological help, and 331 (62.7%) stated that they did not feel any need for psychological help.

For the test-retest study, the RSQ questionnaire was applied at one week interval to 33 people from the sample group, aged between 20-35 (22.09±3.33), of whom 32 were females (97%) and 1 was male (3%).

For criterion-related validity study, BIS/ BAS scale was applied to 72 people aged between 20-35 (22.36±2.78) from the sample group, and Eysenck Personality Questionnaire-Revised Abbreviated Form (EPQR-A) and State-Trait Anxiety Inventory (STAI-II) was applied to 93 people aged between 18-69 (34.62±10.54).

Measurement Tools

Reinforcement Sensitivity Questionnaire (RSQ)

The Reinforcement Sensitivity questionnaire which is developed by Smederevac et al. (16), consists of five subscales *(BAS, BIS, Fight, Flight, Freeze)* and 29 items. During the development of the questionnaire, 565 participants between the ages of 18-60 (34.34 ±11.84) were included in the study. The questionnaire was prepared in four-point Likert scale *(1=completely disagree; 2=somewhat disagree; 3=somewhat agree; 4=completely agree)* and have 60 items initially. However, after excluding the items which were determined as not to related according to the factor analysis, the number of items were decreased to 29. In the criterion-related validity study of the questionnaire, RST-PQ and BIS/BAS questionnaires were used. As a result, it was determined that the subscales in the RSQ were significantly correlated with similar subscales of other RST-based questionnaires. In the study, Cronbach's Alpha values were determined as 0.86 for the BIS, 0.78 for the BAS, 0.82 for the Fight, 0.69 for the Flight, and 0.87 for the Freeze.

Behavioral Activation and Behavioral Inhibition System Scale (BIS/BAS)

The BIS/BAS scale was developed by Carver and White in 1994 (11). There are 24 items in the scale and there are 4 subscales. Subscale headings are *'behavioral inhibition system'*, *'fun seeking'*, *'reward responsiveness'* and *'drive'*. *'Fun seeking'*, *'reward responsiveness'* and *'drive'* subscales are under the behavioral activation system heading. The BIS/BAS scale is a 4-point Likert scale (1=Strongly agree, 2=Agree, 3=Disagree, 4=Strongly Disagree) and it can be applied individually or in groups. There is no time limitation. The validity and reliability study of Turkish version was performed by Şişman (20). In the Turkish validity and reliability study, 371

university students between the ages of 18-25 were included. According to the test-retest reliability analysis results in the study, correlation values were found as 0.69 for behavioral inhibition system, 0.59 for reward responsiveness, 0.58 for fun seeking and 0.80 for drive. Cronbach's Alpha reliability coefficients were determined as 0.69 for behavioral inhibition system, 0.57 for reward responsiveness, 0.63 for fun seeking, and 0.69 for drive.

Eysenck Personality Questionnaire–Revised Abbreviated Form (EPQR-A)

Eysenck Personality Questionnaire was developed by Eysenck and Eysenck (21) and evaluates the dimensions of introversion-extraversion, neuroticism and psychoticism. The Eysenck Personality Questionnaire-Revised Abbreviated Form, consisting of 24 items, was formed by abbreviating the questionnaire consisting of a total of 100 items (22). The Turkish validity and reliability study of the questionnaire was done by Karancı et al. (23). In the study, internal consistency coefficients were found as 0.65 for extraversion, 0.78 for neuroticism, 0.42 for psychoticism and 0.64 for lie subscales. In the test-retest study, the reliability coefficients were determined as 0.84 for neuroticism, 0.82 for extraversion, 0.69 for psychoticism, and 0.69 for lie.

State-Trait Anxiety Inventory (STAI-II)

The inventory was developed by Spielberger et al. in 1970 and the Turkish validity and reliability study of STAI was performed by Öner and Le Compte (24). There are two parts in the questionnaire as the State Anxiety Form in which state anxiety is evaluated, and as the Trait Anxiety Form which evaluates general anxiety. Trait Anxiety Form of the scale was used in our study. It is a four-point Likert scale. In the inventory, 20-39 points indicate low, 40-59 points indicate moderate, 60-80 points indicate high level anxiety. Test-retest reliability coefficients of the questionnaire were found between 0.71 to 0.86, and item reliability coefficients were determined between 0.34 and 0.72.

Procedure

Snezana Smederevac was contacted in February 2020 and permission was requested for the Turkish validity and reliability study of the questionnaire. Translation of the questionnaire was done by two psychologists and an English Language and Literature expert. The translations were compared by the researchers, and the items were examined to determine the level of matching the feature which is desired to be evaluated and the final form of the inventory was formed.

For the study, ethics committee approval was received from İstanbul Sabahattin Zaim University Ethics Committee with the number of 2020/04 on 30.04.2020.

The links prepared by the researchers with the online inventory forms on Google forms were sent to the people around the researchers and they were asked to send the form to their own circle. In the first section of the online form, purpose of the study was stated and no name information was requested, also it was emphasized that the participation in the study was on a voluntary basis, and they could withdraw from the study whenever they want; and participant consent was obtained. However, because it was mandatory for the analysis of the correlation coefficients, student numbers were requested from the students who participated in the test-retest study by emphasized that no individual assessment would be made.

Statistical Analysis

In this study, test-retest application, split-half method and internal consistency analysis were performed within the scope of reliability study. The correlation coefficients between the subscales of the two applications were calculated in the test-retest application; Spearman-Brown and Guttman reliability coefficients were calculated in the split-half method and Cronbach Alpha reliability coefficients were calculated in the internal consistency analysis. Explanatory factor analysis, confirmatory factor analysis and criterion-related validity study were conducted within the scope of validity study. 528 participants were randomly divided in two groups in SPSS and Explanatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were applied separately to the datasets of 264 participants. In Explanatory Factor Analysis, varimax rotation was applied and the conformity of questionnaire for factor analysis was tested with Kaiser-Meyer-Olkin coefficient and Bartlett test. The comparative analyses according to gender were performed with independent samples t-test. In the criterion-related validity study, the Pearson Product-Moment Correlation coefficient method was applied to determine the correlation values between the subscales. Statistical analyses were made with SPSS v25.0 and AMOS program.

RESULTS

Reliability Results

Internal Consistency Analysis: In this study, the Cronbach Alpha reliability coefficients of the subscales were calculated within the scope of the internal consistency analysis of RSQ. According to the results of the reliability analysis, the Cronbach Alpha reliability coefficients were found as 0.71 for "behavioral activation system" (BAS); 0.81 for "behavioral inhibition system" (BIS); 0.78 for "fight"; 0.83 for "flight"; and 0.82 for "freeze". Item total correlation values of items were found as higher than 0.20 (Table 1).

Test-Retest Reliability: RSQ was applied at 1 week interval to 33 university students, 32 female (97%) students and 1 male (3%) student within the scope of test-retest study. The mean age of the participants was 22.09 (sd=3.33) aged between 20-35. The correlation coefficients of the applications were found as 0.73 for "behavioral activation system" (BAS); 0.66 for "behavioral inhibition system" (BIS); 0.84 for "fight"; 0.71 for "flight"; and 0.67 for "freeze".

Split-Half Test Reliability: The split-half method was used to determine internal consistency. As a result of the split-half analysis, the Spearman-Brown reliability coefficient of the questionnaire which was divided into two halves was calculated as 0.85 and the Guttman reliability coefficient was found as 0.85. Cronbach Alpha values were found as 0.70 for the first half and 0.67 for the second half.

Validity Results

Explanatory Factor Analysis: Explanatory factor analysis was applied to the data set of 264 people within the scope of the validity study of RSQ. In the explanatory factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient was found as 0.76; Bartlett test result was determined as $X^2_{(406)}$= 2702.18, p<0.01. These results showed that the scale is suitable for factor analysis. In the analysis, varimax rotation was applied. As a result of the analysis, it was seen that the items were loaded on the relevant subscales and a five-factor structure (BİS %18.44, Flight %12.87, Fight %7.81, Freeze %5.59 and BAS %5.26) was found with an eigenvalue above 1 which explains the 49.96% of the total variance (Table 1).

Confirmatory Factor Analysis: As a result of confirmatory factor analysis which was applied to data set of 264 participants, item 4 and item 9 with factor loads of 0.27 and 0.29 were eliminated. According to the results of the confirmatory factor analysis, X^2/df=3.04 , CFI=0.86, AIC=1081.70, RMSEA=0.08, SRMR=0.10 were determined. Since the CFI value was below the acceptable value of 0.90 (25) in the first analysis, the

Table 1. Results of Explanatory Factor Analysis of RSQ (N=264) and reliability coefficients, corrected item total score correlation, means of subscale scores and item scores and standard deviations (N=528)

Questionnaire items	Factor loads (n=264)	Reliability coefficients and corrected item total score correlation	Mean of item scores (n=528)	sd
Factor 1: BIS Eigenvalue: 5.35 Explained variance: % 18.44		**α =0.81**	**Mean of scale: 16.81 sd:4.86**	
RSQ18	0.71	0.60	2.28	1.01
RSQ21	0.71	0.60	2.18	0.97
RSQ26	0.63	0.51	2.28	1.09
RSQ13	0.60	0.53	2.42	1.04
RSQ2	0.58	0.49	2.51	1.00
RSQ17	0.58	0.58	2.41	1.04
RSQ24	0.52	0.46	2.73	1.01
Factor 2: FLIGHT Eigenvalue: 3.73 Explained variance: % 12.87		**α = 0.83**	**Mean of scale: 14.09 sd:3.70**	
RSQ1	0.87	0.79	2.86	0.97
RSQ23	0.86	0.80	2.81	0.97
RSQ8	0.68	0.55	3.18	0.83
RSQ29	0.67	0.67	2.58	0.99
RSQ10	0.39	0.40	2.66	1.01
Factor 3: FIGHT Eigenvalue: 2.26 Explained variance: % 7.81		**α = 0.78 (excluding item 9)**	**Mean of scale: 12.79 sd: 3.61 (excluding item 9)**	
RSQ20	0.77	0.65	2.74	0.93
RSQ3	0.70	0.61	2.85	0.88
RSQ11	0.69	0.60	2.39	1.01
RSQ12	0.68	0.50	2.47	1.06
RSQ9	0.65	0.46	2.14	1.02
RSQ27	0.57	0.47	2.33	1.06
Factor 4: FREEZE Eigenvalue: 1.62 Explained variance: % 5.59		**α = 0.82**	**Mean of scale:10.34 sd: 3.87**	
RSQ7	0.69	0.65	2.07	0.98
RSQ5	0.67	0.61	2.21	1.02
RSQ22	0.66	0.58	2.14	1.04
RSQ14	0.66	0.63	2.05	1.04
RSQ16	0.61	0.59	1.87	0.99
Factor: 5 BAS Eigenvalue: 1.52 Explained variance: % 5.26		**α = 0.71 (excluding item 4)**	**Mean of scale:14.68 sd: 3.09 (excluding item 4)**	
RSQ28	0.71	0.56	3.08	0.86
RSQ6	0.62	0.50	2.99	0.89
RSQ15	0.61	0.49	3.11	0.85
RSQ19	0.59	0.44	2.86	0.94
RSQ25	0.46	0.34	2.64	1.01
RSQ4	0.40	0.30	2.22	0.98

RSQ, Reinforcement Sensitivity Questionnaire; BIS, Behavioral Inhibition System; BAS, Behavioral Activation System

modifications (item 5-item 7, item 11- item 12 and item 18- item 21) were applied and the CFI value became 0.90. As a result of the modifications made, it was calculated as X^2/df=2.51, CFI=0.90, AIC=913.30, RMSEA= 0.08, SRMR=0.09 (Figure 1) (Table 2).

Correlation Values Between the Subscales of RSQ: Pearson Product Moments Correlation coefficient method was applied to determine the correlation values between subscales. According to the results of the analysis, it was determined that the BAS subscale was positively correlated with the Fight subscale and negatively correlated with the Freeze subscale. It was determined that there were statistically significantly positive correlations between the BIS, Flight and Freeze subscales (Table 3).

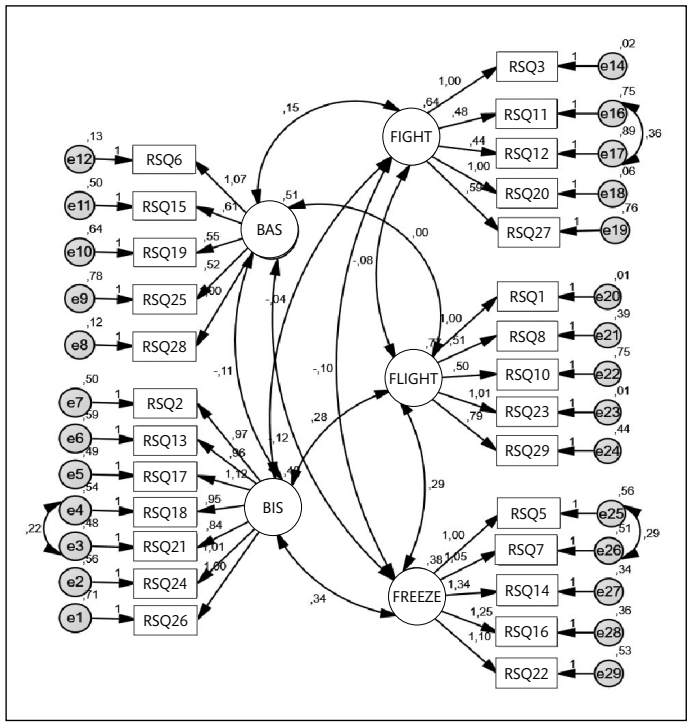

Figure 1. The results of confirmatory factor analysis of Reinforcement Sensitivity Questionnaire (RSQ)

Criterion-Related Validity: Within the scope of criterion-related validity, BIS/BAS scale was applied to 72 people aged between 20-35 (22.36±2.78); Eysenck Personality Questionnaire - Revised Abbreviated Form (EPQR-A) and STAI Trait Anxiety Inventory (STAI-II) were applied to 93 people aged between 18- 69 (34.62±10.54) from the 528 participants included in the study. Pearson Product Moments Correlation coefficient method was applied to determine the relationship between these questionnaires and the subscales of the RSQ. As a result of the analysis, it was found that there was a positive correlation between RSQ-BAS and EPQ-Extraversion, BAS-drive, BAS-fun and BAS-reward, and that there was a negative correlation with STAI-II. Positive correlation was found between RSQ-BIS and EPQ-Neuroticism, STAI-II and BIS and negative correlation was determined between RSQ-BIS and EPQ-Extraversion. Between RSQ-fight and BAS-drive, BAS-fun and BAS-reward positive correlation was determined; and negative correlation was found between RSQ-fight and STAI-II. It was found that there was a positive correlation between the RSQ-flight and the STAI-II, BIS, BAS-reward. Positive correlation was determined between RSQ-freeze and STAI-II, BIS; and a negative correlation was found between RSQ-freeze and BAS-drive (Table 4).

Findings of Subscale Scores According to the Gender

Independent samples t-test was applied to determine whether the RSQ subscale scores differentiate according to gender. As a result of analysis, it was determined that BIS ($t_{(526)}$=4.13; p<0.001), Flight ($t_{(418.12)}$=6.02; p<0.001) and Freeze ($t_{(526)}$=6.00; p<0.001) subscales were differentiated according to gender. The scores of female participants in these three subscales are

Table 2. The results of confirmatory factor analysis good fit indices of RSQ Original Questionnaire, Turkish Questionnaire and Turkish Modification

	X²	df	X2/df	CFI	SRMR	AIC	RMSEA
Acceptable values*	-	-	≤0.3	>0.90	≤0.10	-	≤0.08
RSQ Original	857.67**	367	2.34	0.96	0.07	123.67	0.05 (0.04-0.05)
RSQ Turkish	953.69**	314	3.04	0.86	0.10	1081.70	0.08 (0.08-0.09)
RSQ Turkish (mod.)	779.30**	311	2.51	0.90	0.09	913.30	0.08 (0.07-0.08)

* İlhan & Çetin (25)
*** p<0.01*
RSQ, Reinforcement Sensitivity Questionnaire; CFI, Comparative Fit Index; SRMR, Standardized Root Mean Square Residual; AIC, Akaike Information Criterion; RMSEA, Root Mean Square Error of Approximation

Table 3. The Pearson Product Moments Correlation coefficients between the subscales

		BAS	BIS	Fight	Flight	Freeze
RSQ Original (N=565)	**BAS**	1				
	BIS	-0.30*	1			
	Fight	0.43*	-0.08	1		
	Flight	-0.22*	0.56*	-0.13*	1	
	Freeze	-0.27*	0.65*	-0.25*	0.55*	1
RSQ Turkish (N=528)	**BAS**	1				
	BIS	-0.09	1			
	Fight	0.29*	0.10	1		
	Flight	0.05	0.43*	-0.02	1	
	Freeze	-0.21*	0.58*	-0.05	0.52*	1

**p<0.01*
RSQ, Reinforcement Sensitivity Questionnaire; BIS, Behavioral Inhibition System; BAS, Behavioral Activation System

Table 4. The Pearson Product Moments Correlation coefficients between the subscales of RSQ and BIS/BAS (n=72), EPQR-A (n=93) and STAI-II (n=93)

	RSQ-BAS	RSQ-BIS	RSQ-FIGHT	RSQ-FLIGHT	RSQ-FREEZE
EPQ-NEUROTİCİSM	0.03	0.33**	0.00	0.08	0.10
EPQ-EXTRAVERSION	0.27**	-0.26*	0.13	-0.10	-0.20
EPQ-PSYCHOTICISM	0.17	-0.06	0.05	-0.20	-0.11
STAI-II	- 0.31**	0.55**	-0.21*	0.22*	0.29**
BIS	-0.11	0.52**	-0.09	0.25*	0.28*
BAS-drive	0.65**	0.00	0.50**	-0.17	-0.26*
BAS-fun	0.60**	0.16	0.26*	-0.10	-0.10
BAS-reward	0.33**	0.03	0.28*	0.25*	-0.11

**p<0.05, **p<0.01*
RSQ, Reinforcement Sensitivity Questionnaire; BIS, Behavioral Inhibition System; BAS, Behavioral Activation System; EPQR-A, Eysenck Personality Questionnaire-Revised Abbreviated Form; STAI-II, Trait Anxiety Inventory

Table 5. The independent samples t-test analysis results of RSQ subscales scores according to gender

	Female (N=314) Mean ± sd	Male (N=214) Mean ± sd	df	t	p
BAS	14.55 ± 3.22	14.87 ± 2.89	526	-1.16	0.25
BIS	17.52 ± 4.82	15.77 ± 4.73	526	4.13	<0.001
Fight	12.59 ± 3.73	13.08 ± 3.42	526	-1.52	0.13
Flight	14.88 ± 3.38	12.93 ± 3.84	418.12	6.02	<0.001
Freeze	11.15 ± 3.79	9.15 ± 3.69	526	6.00	<0.001

RSQ, Reinforcement Sensitivity Questionnaire; BIS, Behavioral Inhibition System; BAS, Behavioral Activation System

statistically significantly higher than the scores of male participants. It was determined that BAS and Fight subscale scores weren't differentiated according to gender (p>0.05) (Table 5).

DISCUSSION

In this study, it was aimed to perform the Turkish validity and reliability study of the Reinforcement Sensitivity Questionnaire (16), which was developed on the basis of Reinforcement Sensitivity Theory revised by Gray and McNaughton (8).

After the Turkish translation process of RSQ was completed, within the scope of the reliability study, the reliability coefficients of the subscales were determined by the internal consistency analysis, and the reliability coefficients of the questionnaire were calculated with the test-retest reliability and the split-half test reliability methods. Within the scope of the validity study, the factor structure of the questionnaire was examined with explanatory factor analysis and confirmatory factor analysis, and the correlation values between similar subscales were calculated within the scope of criterion-related validity study. In addition to this, the subscale scores were compared according to gender.

As a result of reliability analysis, the Cronbach Alpha values of the subscales were found between 0.71 and 0.82, and the internal consistency Cronbach Alpha values were found as higher than 0.70 which is accepted as the lower limit (26). Item total correlation values of items were calculated as higher than 0.20 which is accepted as the lower limit. As a result of reliability analysis, from the questionnaire no item was eliminated. In the test-retest study, which was applied with a one-week interval, the correlation coefficients of the subscales were found between 0.66 and 0.84, the mean correlation coefficient was calculated as 0.72, and it was determined that the RSQ has a high time-invariant feature. In the original study of the scale, test-retest study was not applied. As the result of analysis of split-half test reliability, Spearman-Brown and Guttman reliability coefficients were found to be high (0.85).

In order to determine the factor structure of the scale, 29 items which were in the original scale, were included in the explanatory factor analysis. As the result of explanatory factor analysis, the Kaiser-Meyer-Olkin (KMO) coefficient was found as 0.76; and $X^2_{(406)}$= 2702.18, p<0.01 was determined as the result of Bartlett test. These results show that the scale is suitable for factor analysis. As a result of the explanatory factor analysis, a five-factor structure with an eigenvalue above 1 and explaining 49.96% of the total variance was determined. It was found that the scale items were loaded on the relevant subscales in accordance with the original scale.

In the confirmatory factor analysis, on the other hand, since the CFI value was calculated below 0.90 in the first analysis, modifications were made and item 4 and item 9, which were determined as not to be compatible, were eliminated. As a result of item eliminations and modifications, the CFI value reached an acceptable value of 0.90 (25). After the item elimination process was performed, the reliability analyses of the scale were repeated and it was determined that the internal consistency coefficients of the subscales were high. As a result, it was seen that there were 27 items left in the scale and it had a five-factor structure in convenience with the original study.

In the correlation analysis applied for determining the relationship between the subscales, a high correlation was found between the BİS, Flight and Freeze subscales. In the original study of the scale, it was observed that there was a high correlation between these three subscales, and a three-factor model was tested in order to determine whether these three subscales could be evaluated under a single dimension. However, it was determined that the five-factor structure had better fit values than the three-factor structure (16). At this point, it was stated that evaluating the BİS, Flight and Freeze subscales under a single dimension is not

appropriate and that the questionnaire has a five-factor structure in line with the theory. It is thought that one of the reasons for the high correlations between BIS, Flight, and Freeze subscales is the difficulty in distinction between fear and anxiety expressions (16). On the basis of this difficulty, hardness in recognizing negative emotions and recognizing the relation between emotional reactions and behaviors can be stated. In addition to this, linguistic problems can be considered as an obstacle to clear this distinction. In other words, generally the same words are being used to describe different situations. In this regard, there is a high probability of using the expressions of anxiety and fear interchangeably. In addition to these, the fact that fear and anxiety are related to parallel and symmetrical hierarchical neurobiological structures (9) can be shown as one of the reasons for the difficulty in clearing this distinction. Considering that in conflict situations where fear is triggered, anxiety may also arise. Therefore, the similarity of reactions to anxiety and fear and the difficulty of distinguishing them can be better understood. The high correlation between the anxiety-related BIS and the fear-related Flight and Freeze subscales can be explained by these reasons.

When the correlation values between the RSQ subscales were examined, it was found that the BAS and fight subscale; and that the BIS and Flight and Freeze scales were positively correlated, and the results were found to be in convenience with the original study. However, a negative but insignificant correlation was found between BIS and BAS in the Turkish scale different from the original scale. When these results are evaluated in terms of RST and rRST theories, it is seen that although the original study of RSQ was developed according to rRST, the negative and significant correlation between BIS and BAS was found in the results of the original study is consistent with the original RST. Because according to RST, BAS and BIS are the systems that have negatively correlation, when one is activated, the other system is inhibited (2). In rRST, on the other hand, activation of BIS is dependent on conflict situations in which BAS and FFFQ are activated simultaneously. In rRST, a model is offered in which there are independent systems where parallel and simultaneous activation can occur instead of a negative relationship between BIS and BAS systems (8). When the subscale correlation results of Turkish RSQ are examined, it is seen that the BIS and BAS systems are independent from each other. Therefore, it can be said that the results obtained in our study are in convenience with rRST. In a study done by Amiri, Behnezhad, and Azad-Marzabadi (27), in which the psychometric properties of RSQ were examined, it was found that there was no correlation between BAS and BIS. It is seen that this study supports the results of the correlation analysis of the subscales found in our study.

In our study, BIS/BAS, STAI-II and EPQR-A were used in criterion-related validity analyses. In the original study of RSQ, it was seen that BIS/BAS (11) and RST-PQ (15) were used within the scope of criterion-related validity study. In the results of the criterion-related validity analysis, it was determined that both the original study and the Turkish adaptation study showed a positive correlation between reward, anxiety and fear-related subscales, but reward-related subscales were negatively correlated with anxiety and fear-related subscales. When the literature was examined, in a study in which the systems defined in rRST (BIS, BAS, FFFQ) were evaluated with RSQ, it was determined that BIS was a predictive variable for anxiety (28). In another study in which RSQ was used, Randelovic et al. (29) examined the relationship between social phobia and personality types. In the study in which 78 participants were included, the reactions towards social threat and real threats were evaluated and as a result it was determined that BIS has an important role in predicting negative events. In this regard, it is seen that the results obtained in our study are in convenience with both original study and the studies in the literature.

When the RSQ subscales were compared according to gender, it was found that the BIS, Flight and Freeze subscales are statistically significantly differentiated, and the scores of the female participants were higher than the male participants. On the other hand, no differentiation according to gender was determined between BAS and Fight subscales. According to this result, it can be said that emotional, cognitive and behavioral reactions related to anxiety and fear are more common in women. When the literature is examined, there are studies showing that anxiety disorders are higher in women than in men (30). Considering that BIS is associated with generalized anxiety disorder whereas Flight and Freeze systems are related to phobia and panic disorder (8), it can be said that the results of the analysis made according to the gender are being supported by the studies in the literature.

One of the limitations of this study is that the measurements were based on self-report. There is a possibility that the participants responded in the direction of social desirability. Another limitation of the study is that the clinical sample was not included in the study. Redoing the study in different patient groups such as generalized anxiety disorder, phobia, panic disorder, and depression can provide a better evaluation of rRST and also can test the predictive power of RSQ as a psychometric measurement tool in clinical samples. The fact that the study was conducted in a community sample, the number of female and male participants was close to each other, and the psychometric results of the scale were in convenience with the original study and the literature can be considered as the strengths of the study. In conclusion, this study, which was carried out within the scope of the Turkish adaptation of RSQ, shows that the scale is valid and reliable for Turkish community.

Ethics Committee Approval: For the study, ethics committee approval was received from İstanbul Sabahattin Zaim University Ethics Committee with the number of 2020/04 on 30.04.2020.

Informed Consent: In the first section of the online form, purpose of the study was stated and no name information was requested, also it was emphasized that the participation in the study was on a voluntary basis, and they could withdraw from the study whenever they want and participant consent was obtained.

Peer-review: Externally peer-reviewed

Author Contributions: Concept– GB, YB; Design– GB, YB; Supervision– GB, YB; Resources– GB, YB; Materials– (-); Data Collection and/or Processing– GB, YB; Analysis and/or Interpretation– GB, YB; Literature Search– GB, YB; Writing Manuscript– GB, YB; Critical Review– GB, YB

Conflicts of Interest: There is no conflict of interest for the article.

Financial Support: No financial support was received in the preparation of this article.

REFERENCES

1. Eysenck HJ. The biological basis of personality. Springfield: Thomas; 1967.
2. Gray JA. A Critique of Eysenck's Theory of Personality. Eysenck HJ, editor. A Model of Personality. New York: Springer; 1981. p.246–276. [Crossref]
3. Pickering AD, Diaz A, Gray JA. Personality and reinforcement: An exploration using maze-learning task. Pers Individ Differ 1995;18:541–558. [Crossref]
4. Vervoort L, Wolters LH, Hogendoorn SM, De Haan E, Boer F, Prins PJ. Sensitivity of Gray's behavioral inhibition system in clinically anxious and non-anxious children and adolescenta. Pers Individ Differ 2010;48:629–633. [Crossref]
5. Mashrouti P, Dolatshahi B, Khani PM, Pourshahbaz A, Mohammadi F. Explaining the psychological symptoms in students based on Gray's Biological Models of Personality. Int J Appl Behav Sci 2016;3:18–24. [Crossref]
6. Bilge Y, Bilge Y. Behavioral inhibition and behavioral activation system levels, and DSM-5 psychopathological symptoms in Turkish adolescents. Int Rev Hum Sci Res (IRHSR) 2018;3:88–98. https://www.irhsr.org/papers/1523075814.pdf
7. Segarra P, Ross SR, Pastor MC, Montañés S, Poy R, Moltó J. MMPI-2 predictors of Gray's two-factor reinforcement sensitivity theory. Pers Individ Differ 2007;43:437–448. [Crossref]

8. Gray JA, Mcnaughton N. The neuropsychology of anxiety: An enquiry in to the functions of the septo-hippocampal system 2nd ed. Oxford: Oxford University Press; 2000.
9. Corr PJ, DeYoung CG, McNaughton N. Motivation and personality: A neuropsychological perspective. Soc Personal Psychol Compass 2013;7:158–175. [Crossref]
10. Blanchard DC, Griebel G, Blanchard RJ. Mouse defensive behaviours: Pharmacological and behavioral assays for anxiety and panic. Neurosci Biobehav Rev 2001;25:205–218. [Crossref]
11. Carver CS, White T. Behavioral inhibition, behavioural activation, and affective responses to impending reward and punishment: the BIS/BAS scales. J Pers Soc Psychol 1994;67:319–333. [Crossref]
12. Torrubia R, Avila C, Molto J, Caseras X. The sensitivity to punishment and sensitivity to reward questionnaire (SPSRQ) as a measure Gray's anxiety and impulsivity dimensions. Pers Individ Differ 2001;31:837–862. [Crossref]
13. Colovic P, Smederevac S, Olijaca M, Nikolasevic Z, Mitrovic D. A short measure of the revised reinforcement sensitivity theory - RSQ17. J Psychol 2018;152:133–150. [Crossref]
14. Jackson CJ. Jackson-5 scales of revised reinforcement sensitivity theory (r-RST) and their application to dysfunctional real world outcomes. J Res Pers 2009;43:556–569. [Crossref]
15. Corr PJ, Cooper AJ. The reinforcement sensitivity theory of personality questionnaire (RST-PQ): Development and validation. Psychol Assess 2016;28:1427–1440. [Crossref]
16. Smederevac S, Mitrovic D, Colovic P, Nikolasevic Z. Validation of the measure of revised reinforcement sensitivity theory constructs. J Individ Differ 2014;35:12–21. [Crossref]
17. Reuter M, Cooper AJ, Smillie LD, Markett S, Montag C. A new measure for the Revised Reinforcement Sensitivity Theory: Psychometric criteria and genetic validation. Front Syst Neurosci 2015;9:38. [Crossref]
18. Maack DJ, Buchanan E, Young J. Development and psychometric investigation of an inventory to asess fight, flight, and freeze tendencies: The Fight, Flight, Freeze Questionnaire. Cogn Behav Ther 2014;44:117–127. [Crossref]
19. Colder CR, Trucco EM, Lopez HI, Hawk LW Jr, Read JP, Lengua LJ, Weiczorek WF, Eiden RD. Revised reinforcement sensitivity theory and laboratory assessment of BIS and BAS in children. J Res in Pers 2011;45:198–207. [Crossref]
20. Şişman S. Davranışsal İnhibisyon Sistemi/Davranışsal Aktivasyon Sistemi Ölçeği'nin Türkçe'ye uyarlanması: Geçerlik ve güvenirlik çalışması. Psikoloji Çalışmaları 2012;32:1–22. https://dergipark.org.tr/tr/download/article-file/404915
21. Eysenck HJ, Eysenck SBG. Manual of the Eysenck personality questionnaire. Kent, UK: Hodder and Stoughton; 1975.
22. Francis LJ, Brown LB, Philipchalk R. The development of an abbreviated form of the Revised Eysenck Personality Questionnaire (EPQR-A): Its use among students in England, Canada, the USA and Australia. Pers Individ Differ 1992;13:443–449. [Crossref]
23. Karancı N, Dirik G, Yorulmaz O. Eysenck Kişilik Anketi-Gözden Geçirilmiş Kısaltılmış Formu'nun (EKA-GGK) Türkiye'de geçerlik ve güvenirlilik çalışması. Türk Psikiyatri Derg 2007;18:1–8. http://turkpsikiyatri.com/Data/UnpublishedArticles/eysenck.pdf
24. Büyüköztürk Ş. Faktör Analizi: Temel kavramlar ve ölçek geliştirmede kullanımı. Kuram ve Uygulamada Eğitim Yönetimi 2002;32:470–480. https://dergipark.org.tr/tr/download/article-file/108451
25. İlhan M, Çetin B. LISREL ve AMOS programları kullanılarak gerçekleştirilen yapısal eşitlik modeli (yem) analizlerine ilişkin sonuçların karşılaştırılması. Eğitimde ve Psikolojide Ölçme ve Değerlendirme Derg 2014;5:26–42. [Crossref]
26. Nunnally JC, Bernstein IH. Psychometric Theory, 3rd ed. New York: McGraw-Hill Inc; 1994. (Orijinal basım: 1967).
27. Amir S, Behnezhad S, Azad-Marzabadi E. Psychometric properties revised reinforcement sensitivity theory (r-RST) scale in chronic pain patients. J Pain Res 2017;10:1879–1885. [Crossref]
28. Mihic L, Colovic P, Ignjatovic I, Smederevac S, Novovic Z. Anxiety between personality and cognition: The gray zone. Pers Individ Differ 2015;78:19–23. [Crossref]
29. Randelovic K, Smederevac S, Colovic P, Corr PJ. Fear and Anxiety in Social Setting An Experimental Study. J Individ Differ 2018;39:61–75. [Crossref]
30. Bilge Y, Bilge Y. The examination of the relationship between gender and socio-economic level factors with psychological disorders in adolescents in Turkey. Global Journal of Psychology Research: New Trends and Issues 2017;7:100–110. [Crossref]