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Reward and punishment sensitivity in women with gambling disorder or compulsive buying: Implications in treatment outcome

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Background and aims: Gray's Reinforcement Sensitivity Theory has been widely applied to different clinical populations, but few studies have reported empirical evidence based on this theory for treatment outcomes in patients with gambling disorder (GD) and compulsive buying (CB). The aims of this study were to explore the association between clinical variables and personality traits with reward and punishment sensitivity (RPS) levels in women ($n = 88$) who met diagnostic criteria for GD ($n = 61$) and CB ($n = 27$), and to determine the predictive capacity of RPS for primary short-term outcomes in a cognitive-behavioral therapy (CBT) intervention. *Methods:* The CBT intervention consisted of 12 weekly sessions. Data on patients' personality traits, RPS levels, psychopathology, sociodemographic factors, GD, and CB behavior were used in our analysis. *Results:* High RPS levels were associated with higher psychopathology in both CB and GD, and were a risk factor for dropout in the CB group. In the GD group, higher reward sensitivity scores increased the risk of dropout. *Discussion and conclusions:* Our findings suggest that both sensitivity to reward and sensitivity to punishment independently condition patients' response to treatment for behavioral addictions. The authors uphold that CBT interventions for such addictions could potentially be enhanced by taking RPS into consideration.

Keywords: compulsive buying, gambling disorder, cognitive-behavioral therapy, dropout, relapse, reward and punishment sensitivity

INTRODUCTION

Gambling disorder (GD) constitutes a psychiatric condition characterized by recurrent, maladaptive gambling behavior that leads to clinically significant distress. GD was recently reclassified into the "Substance-Related and Addictive Disorders" group of the DSM-5 (American Psychiatric Association, 2013). Likewise, compulsive buying (CB) is characterized by the persistent, excessive, impulsive, and uncontrollable purchase of products in spite of severe psychological, interpersonal, social, occupational, and financial consequences (Aboujaoude, 2014; Müller, Mitchell, & de Zwaan, 2015). Both of these conditions are best classified as behavioral addictions, though CB was not included in the latest version of the DSM-5 due to insufficient empirical evidence and a lack of consensus on diagnostic criteria (Piquet-Pessôa, Ferreira, Melca, & Fontenelle, 2014; Potenza, 2014). Evidence for shared features between CB and GD has been reported and because of this, both have been proposed for conceptualization on the compulsive–impulsive spectrum (Bottesi, Ghisi, Ouimet, Tira, & Sanavio, 2014; Yi, 2013). Among their shared features the following are highlighted: the urge to achieve immediate gratification or relieve of a negative emotion through an impulsive/compulsive behavior, the early onset of the problematic addictive behavior, and impaired money management skills (Granero et al., 2016).

As an essential feature of behavioral addictions is the failure to resist an impulse, drive, or temptation to perform a harmful act (Grant, Potenza, Weinstein, & Gorelick, 2010), Gray's Reinforcement Sensitivity Theory provides a useful framework for understanding such behavior in terms of the

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sensitivity of brain systems to punishment and reward. This theory asserts that the punishment sensitivity regulates responses to stimuli perceived as potentially dangerous, and thereby leads individuals to their avoidance (the behavioral inhibition system). Its counterpart, reward sensitivity, directs behavior toward appetitive stimuli that provide immediate compensation (the behavioral activation system). It is worth noting that this model has been updated to incorporate findings from different areas in psychology and neuroscience (Gray & McNaughton, 2000), and now includes a Fight–Flight–Freezing system that controls avoidance and generating risk assessment.

On the one hand, high levels of reward sensitivity have been associated with a wide range of psychiatric conditions, including behavioral addictions. In the case of GD, a number of studies have found that high self-reported levels of reward sensitivity tend to correlate more strongly with gambling behavior than punishment sensitivity (Jiménez-Murcia et al., 2016; Wardell, Quilty, Hendershot, & Bagby, 2015). On the other hand, results regarding punishment sensitivity have been inconsistent with some studies reporting that levels may be higher in behavioral addictions (Dong, Hu, & Lin, 2013), whereas other studies have identified no association.

In addition, research has found that individuals with high reward sensitivity are motivated to engage in behaviors that provide both internal and external reinforcement in the form of enhancement/winning motives and social motives, respectively (Sztainert, Wohl, McManus, & Stead, 2014; Wardell et al., 2015). Similarly, greater CB tendencies have been positively associated with reward sensitivity, which has been reported to be a powerful predictor of CB severity (Lawrence, Ciorciari, & Kyrios, 2014).

Nonetheless, studies relating reward and punishment sensitivity (RPS) to GD and CB are scarce and research in this field is still in its nascent stages – especially in the case of CB. In order to improve treatment interventions for GD and CB, a better understanding of the mechanisms underpinning these psychiatric conditions is required. Likewise, since different behavioral profiles by gender have been identified (Fattore, Melis, Fadda, & Fratta, 2014), more studies are needed to separately analyze these factors in male and female populations. To our knowledge, no empirical study has explored the effect of personality traits and RPS levels on treatment outcome in women with either GD or CB.

The aims of this study were: (a) to explore the association between demographic variables, personality traits, and RPS in subsamples of women who met criteria for GD or CB; and (b) to estimate the predictive capacity of the RPS levels on GD and CB treatment outcome, namely considering compliance with the therapeutic guidelines, relapse, and dropout. We hypothesized that in both behavioral addictions, high levels in RPS would be associated with poor response to treatment.

METHODS

Participants

Participants included consecutively recruited women at the Pathological Gambling Unit at a University Hospital who voluntarily sought treatment for GD ($n = 61$) or CB ($n = 27$). The recruitment took place during January 2011 to March 2015. Exclusion criteria were the presence of an organic mental disorder or a comorbid behavioral addiction, an intellectual disability or an active psychotic disorder.

Measures

Diagnostic criteria for GD. Patients were diagnosed with pathological gambling if they met DSM-IV-TR criteria (American Psychiatric Association, 2000). It should be noted that with the release of the DSM-5 (American Psychiatric Association, 2013), the term pathological gambling was replaced with GD.

Diagnostic criteria for CB (McElroy, Keck, Pope, Smith, & Strakowski, 1994). Diagnostic criteria for CB were determined according to the guidelines set by McElroy et al. (1994). The authors suggested that CB should be considered a separate diagnostic category. They proposed some preliminary criteria for CB that have received wide acceptance in the research community, although their reliability and validity have not yet been determined (Tavares, Lobo, Fuentes, & Black, 2008). It is worth noting that no formal diagnostic criteria for CB have been accepted for the DSM or the ICD 10. At present, it is recommended that CB diagnosis is determined via detailed face to face interviews, which explore "buying attitudes, associated feelings, underlying thoughts, and the extent of preoccupation with buying and shopping" (Müller et al., 2015) and which determine that excessive buying behavior does not occur exclusively during episodes of mania or hypomania.

Symptom Checklist-Revised (SCL-90-R; Derogatis, 1990). This is a 90-item questionnaire measuring psychological distress and psychopathology. The items assess nine symptom dimensions: somatization, obsessive–compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. The global score (Global Severity Index, GSI) is a widely used index of psychopathological distress. The Spanish adapted version was used in this study (Derogatis, 2002). Cronbach's α in this sample was in the good to excellent range (Table 2 includes α values for each scale).

Temperament and Character Inventory-Revised (TCI-R; Cloninger, 1999). This is a self-report, 240-item inventory to evaluate personality traits. Responses are noted on a 5-point Likert-type scale. It is structured in seven primary dimension scores: four temperamental factors (novelty seeking, harm avoidance, reward dependence, and persistence) and three character dimensions (self-directedness, cooperativeness, and self-transcendence). The Spanish revised version used in this study showed adequate internal consistency, with a Cronbach's α mean value equal to .87 (Gutiérrez-Zotes et al., 2004). Cronbach's α in the sample was in the moderate to excellent range (α values are in Table 2).

Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia, Ávila, Moltó, & Caseras, 2001). This is a self-report questionnaire including 48 items on RPS. Raw scores are obtained as the sum of the affirmative responses with higher scores indicating higher RPS. Based on the original version, three clinical ranges can be established: normal (*T*-score under 60), subclinical (*T*-score between 60 and 70), and clinical (*T*-score higher than 70). Internal consistency in this sample obtained through Kuder and Richardson coefficient for measures with dichotomous choices was

Table 1. Descriptive for the sample

	Gambling disorder $n = 61$	Compulsive buying $n = 27$	Statistic[a]	*df*	*p*
Origin; *n* (%)					
Spain	53 (86.9%)	27 (100.0%)	3.89	1	**.048**
Other	8 (13.1%)	0 (0%)			
Education level; *n* (%)					
Primary	29 (47.5%)	12 (44.4%)	2.33	2	.312
Secondary	24 (39.3%)	8 (29.6%)			
University	8 (13.1%)	7 (25.9%)			
Civil status					
Single	25 (41.0%)	10 (37.0%)	0.14	2	.934
Married – together	26 (42.6%)	12 (44.4%)			
Divorced – separated	10 (16.4%)	5 (18.5%)			
Employment status; *n* (%)					
Unemployed	34 (55.7%)	9 (33.3%)	3.86	1	**.050**
Age (years); mean (*SD*)	48.16 (12.86)	41.00 (9.43)	6.75	1;86	**.011**
Onset of disorder (years); mean (*SD*)	33.63 (12.52)	29.81 (9.43)	1.98	1;86	.163
Duration of disorder (years); mean (*SD*)	14.86 (10.56)	11.19 (7.52)	2.66	1;86	.107
SPSR: raw total scores					
Sensitivity punishment; mean (*SD*)	14.02 (5.91)	13.74 (6.60)	0.04	1;86	.846
Sensitivity to reward; mean (*SD*)	10.33 (4.70)	10.74 (5.40)	0.13	1;86	.718
SPSR: clinical ranges; *n* (%)					
S. Punishment: normal ($T < 60$)	35 (57.4%)	16 (59.3%)	0.03	2	.984
S. Punishment: subclinical ($60 < T < 70$)	21 (34.4%)	9 (33.3%)			
S. Punishment: clinical ($T > 70$)	5 (8.2%)	2 (7.4%)			
S. Reward: normal ($T < 60$)	27 (44.3%)	11 (40.7%)	0.13	2	.936
S. Reward: subclinical ($60 < T < 70$)	16 (26.2%)	8 (29.6%)			
S. Reward: clinical ($T > 70$)	18 (29.5%)	8 (29.6%)			
Primary treatment outcomes					
Compliance; *n* (%)					
Poor	8 (13.1%)	7 (25.9%)	2.92	2	.232
Fair	40 (65.6%)	13 (48.1%)			
Good	13 (21.3%)	7 (25.9%)			
Presence of relapses; *n* (%)	21 (34.4%)	16 (59.3%)	4.74	1	**.030**
Dropout; *n* (%)	41 (67.2%)	11 (40.7%)	5.43	1	**.020**

Note. SD: standard deviation. Bold values: significant parameter (.05 level).
[a]Statistic: χ^2 for categorical variables and *F* test for quantitative.

excellent (Kuder & Richardson, 1937) ($p = .85$ for punishment sensitivity and $p = .84$ for reward sensitivity).

Additional data. Demographic, clinical, and social/family variables related to gambling/CB behavior were measured using a semi-structured face-to-face clinical interview (Jiménez-Murcia, Aymamí-Sanromà, Gómez-Peña, Álvarez-Moya, & Vallejo, 2006).

Procedure

All participants were assessed in two face-to-face clinical interviews by expert clinical psychologists and psychiatrists with more than 15 years of clinical experience carrying out cognitive-behavioral therapy (CBT) interventions for individuals with behavioral addictions.

CBT program. Patients were assigned to a 12-week, manualized CBT program. GD and CB patients were treated separately, though the CBT intervention for both conditions shared common elements. This standardized CBT intervention used in this sample has already been described (Jiménez-Murcia et al., 2006) and its short- and medium-term effectiveness has been reported for behavioral addictions (Jiménez-Murcia et al., 2007, 2015). The general topics addressed in the intervention included psychoeducation regarding the disorder (its course, vulnerability factors, diagnostic definition, phases, etc.), stimulus control (such as money management and avoidance of potential triggers), reinforcement and self-reinforcement, skills training, cognitive restructuring, and relapse prevention techniques. In the case of GD, specific sessions were dedicated to topics such as illusions of control over gambling and magical thinking, whereas, in the case of CB, issues regarding responsible buying behavior and exposure response prevention.

The goal of the treatment was to train patients to implement CBT strategies in order to minimize gambling/CB maladaptive behaviors. As per GD, arriving at full abstinence was the ultimate goal of the treatment program, whereas for patients with CB, control over purchases was

Table 2. Correlation between clinical measures and sensitivity to punishment/reward scores

		Gambling disorder $n = 61$		Compulsive buying $n = 27$	
		Punishment	Reward	Punishment	Reward
Age (years)		−.102	−.183	−.183	−.174
Onset of the disorder (years)		−.093	−.225	−.183	.022
Duration of the disorder (years)		−.028	.040	.004	−.241
Maximum spending/episode (€)		.270*	−.098	.246	**.439***
Mean spending/episode (€)		.135	.018	**.302***	**.364***
Cumulate debts (€)		.181	−.070	.159	.284
SCL-90R: Somatization	α = .92	**.398***	**.386***	**.407**	**.476**
SCL-90R: Obsessive/compulsive	α = .89	**.525****	**.427****	**.523****	**.581****
SCL-90R: Interpersonal sensitivity	α = .88	**.651****	**.359***	**.622****	**.552****
SCL-90R: Depressive	α = .91	**.511****	**.347***	**.579****	**.437***
SCL-90R: Anxiety	α = .90	**.555****	**.426****	**.548****	**.567****
SCL-90R: Hostility	α = .80	.289	**.505****	**.463***	**.428***
SCL-90R: Phobic anxiety	α = .87	**.603****	**.333***	**.437***	**.511****
SCL-90R: Paranoid Ideation	α = .70	**.324***	**.342***	**.441***	**.439***
SCL-90R: Psychotic	α = .85	**.489****	**.390***	**.503****	**.610****
SCL-90R: GSI score	α = .98	**.576****	**.453****	**.565****	**.580****
SCL-90R: PST score	α = .98	**.576****	**.521****	**.618****	**.600****
SCL-90R: PSDI score	α = .98	**.497****	**.338***	**.415***	**.401***
TCI-R: Novelty seeking	α = .65	−.159	.125	−.107	**.465***
TCI-R: Harm avoidance	α = .84	**.711***	.181	**.680****	.245
TCI-R: Reward dependence	α = .74	−.082	.021	−.244	.164
TCI-R: Persistence	α = .86	−.199	.073	.049	**.323***
TCI-R: Self-directedness	α = .85	**−.492****	**−.442***	**−.660****	**−.532****
TCI-R: Cooperativeness	α = .83	−.146	−.271*	**−.483***	**−.423***
TCI-R: Self-transcendence	α = .84	−.049	.064	.078	**.532****

Note. α: Chronbach's alpha in the study sample. Bold values: good effect size ($|r| > .30$).
*$p < .05$, **$p < .001$.

sought after. Both CB episodes and gambling episodes are defined as non-planned purchasing or gambling characterized by impulsive urges and negative urgency, followed by feelings of loss of control and guilt.

Throughout the treatment period, compliance with the treatment guidelines (subjectively rated by the therapist as good, fair, or poor) was recorded on an observation sheet by the attending therapist and a clinically trained co-therapist. Other factors, such as patient attendance, control of spending, gambling/CB behavior, and the occurrence of relapses were also registered. Failure to attend three consecutive CBT sessions was considered a criterion for dropout.

Statistical analysis

Statistical analysis was carried out with Stata13.1 for Windows. First, comparisons for sociodemographic and clinical variables between GD and CB groups were executed with chi-square (χ^2) test for categorical indicators and Analysis of Variance for quantitative indicators. Second, Pearson's correlations (r coefficients) measured the association between RPS levels and clinical variables: onset and duration of the disorder, maximum and mean spending per gambling/buying episode, cumulate debts, and SCL-90-R and TCI-R scores. Due to the strong association between the significance level for the r coefficients and the sample size (only r values with high effect sizes achieve significant p values in significance tests obtained for low samples, while r values with low effect sizes tend to obtain significant p values in large samples), only r coefficients with good effect size were considered as relevant in this work. $|r| > .30$ was considered as good effect size. Finally, logistic regressions measured the contribution of RPS levels (defined in these models as the independent variables and analyzed as the direct raw scores, with a metrical scale) on the three primary treatment outcomes (dependent variables): compliance, relapses, and dropout. Since a logistic model is a regression for binary dependent variables, poor compliance with therapeutic guidelines was defined (assigning the code 1 to patients with poor compliance and code 0 to patients with moderate or bad compliance). For relapses, 1 was assigned to patients who reported at least one relapse episode during treatment and 0 was assigned to patients without any relapse episodes. For dropout criterion, code 1 was assigned to patients who abandoned treatment and code 0 assigned to patients who completed treatment. For these logistic models, Hosmer–Lemeshow tests valued goodness-of-fit, Nagelkerke's pseudo-R^2 examined global predictive capacity, and the area under the ROC curve (AUC) was used to asses global discriminative ability.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The Hospital Ethics Committee

of Clinical Research approved the study. All subjects were informed about the study and all provided informed consent.

RESULTS

Characteristics and comparisons between GB and CB

Table 1 contains the sociodemographic and clinical comparisons between the GD and CB samples. The frequency distribution for the origin and employment status was significantly different: all participants in the CB group were native to Spain, whereas 13.1% of the GD sample was foreign. Also, the prevalence of unemployment was lower in the CB group (33.3% vs. 55.7%). Mean age was lower for patients with CB compared to patients with GD (41.0 vs. 48.2 years). Mean SPSRQ total raw scores were statistically equal in both groups, as well as the prevalence of patients in each clinical range (normal–subclinical–clinical). Based on the data published in Torrubia et al. (2001), which includes the psychometrical adaptation of the SPSRQ to the Spanish population, the overall prevalence of patients in subclinical and clinical ranges for the SPSRQ scales in this work was high (around 40% of the sample). With regards to CBT development/course, no differences appeared in the compliance levels with therapeutic guidelines, though the risk of relapses was higher for patients with CB (59.3% vs. 34.4%), and the risk of dropout was higher for patients with GD (67.2% vs. 40.7%).

Association between RPS with clinical profile

Table 2 contains Pearson's correlations estimating the association between the RPS scores with clinical and personality profiles. For women in the GD group, higher levels of RPS scores were associated with higher psychopathology levels and lower self-directedness, while higher sensitivity to punishment scores were specifically related to high harm avoidance. For women in the CB group, higher RPS scores were related to higher spending during CB episodes, higher psychopathology levels, and lower self-directedness and cooperativeness. In addition, higher sensitivity to reward scores also correlated with novelty seeking, persistence, and self-transcendence, while sensitivity to punishment positively correlated with harm avoidance.

Predictive capacity of RPS on CBT outcome

Table 3 contains the logistic models measuring the predictive capacity of RPS levels on primary CBT outcomes: poor compliance, presence of relapses, and dropout during treatment. In the GD sample, higher reward sensitivity scores increased the risk of dropout. In the CB sample, higher reward sensitivity scores predicted the poor compliance and decreased the risk of dropout, while high punishment sensitivity increased the risk of dropout.

Table 3. Predictive capacity of sensitivity to punishment/reward measures on primary treatment outcomes: logistic regressions

	Gambling disorder					Compulsive buying				
	B	SE	*p*	OR	95% CI (OR)	*B*	SE	*p*	OR	95% CI (OR)
Bad compliance										
Punishment	−0.02	0.07	.760	0.98	0.85 (1.13)	0.02	0.11	.863	1.02	0.82 (1.26)
Reward	−0.04	0.06	.433	0.96	0.86 (1.07)	0.27	0.14	**.007**	1.31	1.00 (1.72)
Constant	−0.50	0.91	.587	0.61		−5.62	2.42	.020	0.00	
Fitting:										
H-L	.334					.752				
R^2	.023					.378				
AUC	.554					.850				
Relapses										
Punishment	0.05	0.06	.444	1.05	0.93 (1.18)	0.12	0.09	.177	1.13	0.95 (1.35)
Reward	0.01	0.05	.794	1.01	0.92 (1.11)	−0.05	0.07	.517	0.95	0.83 (1.10)
Constant	−1.31	0.86	.126	0.27		−0.26	1.08	.811	0.77	
Fitting:										
H-L	.761					.220				
R^2	.019					.100				
AUC	.602					.659				
Dropout										
Punishment	−0.08	0.06	.198	0.92	0.81 (1.04)	0.24	0.13	**.020**	1.28	1.00 (1.64)
Reward	0.09	0.05	**.050**	1.10	1.00 (1.21)	−0.21	0.10	**.012**	0.81	0.66 (0.99)
Constant	0.30	0.82	.715	1.35		−0.17	1.14	.885	0.85	
Fitting:										
H-L	.117					.327				
R^2	.091					.335				
AUC	.662					.778				

Note. H-L: Hosmer–Lemeshow test; R^2: Nagelkerke's pseudo-coefficient; AUC: area under the ROC curve. Bold values: significant parameter (.05 level).

DISCUSSION

The purpose of this study was to assess the relationships between RPS levels with clinical variables and personality traits in treatment-seeking women who met diagnostic criteria for GD and CB, and to estimate the discriminative capacity of RPS levels on primary short-term outcomes for CBT. In both groups, high RPS levels correlated with high psychopathology and lower self-directedness. For the CB group, high RPS levels were related to higher spending during CB episodes and low cooperativeness. Likewise, high sensitivity to reward levels correlated with high novelty seeking, persistence, and self-transcendence, and high sensitivity to punishment levels positively correlated with harm avoidance.

Our results showing that worse psychopathology levels are associated with high RPS are consistent with other studies showing wide-ranging symptomology between both clinical and non-clinical groups with high levels of these traits (Hundt et al., 2013; Loxton & Dawe, 2001). These findings support the notion that these disorders share a similar phenotype characterized by an impulsive–compulsive nature (Choi et al., 2014; Yi, 2013), and that both could be located on the impulsive–compulsive spectrum (McElroy, Hudson, Pope, Keck, & Aizley, 1992). However, our results contradict previous studies in which the authors described an association between low levels of punishment sensitivity and addictive behaviors (Dong, Huang, & Du, 2011).

As hypothesized, patients with GD with higher reward sensitivity scores were more likely to dropout from treatment. One study (Wardell et al., 2015) in a community sample of gamblers found that high reward sensitivity levels were associated with greater gambling frequency and interestingly with social gambling motives. Being that a key component of our CBT intervention involves cutting ties with people and/or environments that could potentially cause a patient to relapse, patients who possess stronger social bonds to gambling might be more reluctant to stay in treatment when confronted. This rationale is consistent with other research that found that higher reward sensitivity levels undermined treatment seeking among pathological gamblers (Sztainert et al., 2014) and as such, patients with this trait could very well be less motivated to stay in treatment. Other studies propose that the GD in early stages could be categorized as an ego-syntonic disorder because the patient seeks immediate reward and does not experience associated distress (El-Guebaly, Mudry, Zohar, Tavares, & Potenza, 2012). As such, a subjectively positive experience of gambling behavior could negatively influence treatment adherence.

In the case of patients with CB, higher reward sensitivity levels were associated with poorer adherence to treatment guidelines. This is line with other research that found sensitivity to reward to be an important predictor of CB severity (Lawrence et al., 2014), though it is worth noting that this study included a small, community-based sample. Patients with high reward sensitivity most likely experience stronger intrusive urges to buy, which could interfere with the patients' ability to curb their buying behavior and carry out the tasks that make up the CBT program. Interestingly, higher levels of reward sensitivity were associated with reduced risk of dropout. It is possible that patients with CB disorder are motivated by social factors and, therefore, are more likely to form a therapeutic alliance and not abandon treatment (Lourenço Leite, Pereira, Nardi, & Silva, 2014). Likewise, patients with high levels of punishment sensitivity had an increased risk of dropping out of treatment. One study examining CB characteristics in college students identified that among students who met criteria for CB, greater psychiatric comorbidity, increased stress, and poorer physical health were associated with CB symptoms (Harvanko et al., 2013). Therefore, as individuals with greater punishment sensitivity are vulnerable negative emotions, including frustration, anxiety, fear, and sadness (Gray, 1991), CB may serve as a form of negative reinforcement in such cases. This is line with other research that found sensitivity to reward to be an important predictor of CB severity (Lawrence et al., 2014), though it is worth noting that this study included a small, community-based sample.

Limitations

There are several limitations to this study. First, all data were collected from women who sought treatment. Future studies should aim to include and compare male participants. Second, the lack of a control group does not allow for the exploration of variability among clinical groups. Third, our sample size for each diagnostic subtype was rather modest, and this limits the statistical power of our analysis. Finally, this study was limited by the absence of a validated instrument to assess CB behavior at baseline.

CONCLUSIONS

Gray's Reinforcement Sensitivity Theory states that the expression of some psychological phenotypes is the consequence of individual differences in sensitivity to reward and sensitivity to punishment (Torrubia & Tobeña, 1984). This study found that high RPS levels were associated with worse psychological adjustment, treatment outcomes, higher scores in novelty seeking, persistence, and self-transcendence, and lower scores in self-directedness and cooperativeness. Ultimately, these results provide additional evidence regarding the validity of Gray's Reinforcement Sensitivity Theory in patients with GD and CB.

High levels in both sensitivity to reward and sensitivity to punishment influence the patients' response to treatment by worsening compliance and increasing the risk of relapse and dropout. This information could be used to develop targeted interventions aimed at strengthening the effectiveness of CBT programs for behavioral addictions. Further studies should be carried out in order to validate these results in other disorders, which are part of the impulsive–compulsive spectrum.

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Authors' contribution: GM-B and RG shared first authorship. GM-B, TS, FF-A, CS-M, JFN, JCP, and SJ-M contributed to the development of the study concept and design. RG performed the statistical analysis. GM-B, TS, FF-A, MB, NA, MG-P, ZA, NM-B, LM, AdP-G, and SJ-M aided with interpretation of data. FF-A, CS-M, JMM, JCP, and SJ-M obtained funding. FF-A, JMM, and SJ-M supervised the study.

Conflict of interest: The authors declare no conflict of interest.

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