An experimental investigation of the role of delay discounting and craving in gambling chasing behavior

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Abstract

Chasing is a central feature of gambling disorder and refers to the attempt by individuals to recover financial losses by continuing to gamble. Although several efforts have been made to individuate the factors involved in the complex phenomenon of chasing, little is known regarding its association with delay discounting and craving, both considered important in the development and maintenance of gambling disorder. In the present study, the interplay between chasing, delay discounting, and craving (while controlling for gambling severity) was investigated. The sample comprised 128 adult gamblers aged between 18 and 67 years and consisted of non-problem gamblers (n=58), problem gamblers (n=18), and pathological gamblers (n=52) based on the South Oaks Gambling Screen (SOGS) scores. Participants were administered the Monetary Choice Questionnaire (MCQ) and the Gambling Craving Scale (GACS), as well as completing the ChasIT, a computerized task assessing chasing behavior. Participants were randomly assigned to the control and the loss condition of the ChasIT. Results showed that pathological gamblers were more likely to chase and reported more severe chasing persistence. Regression analyses indicated that heightened levels of craving and the inability to tolerate delay in gratification, along with gambling severity, predicted both the decision to chase and chasing persistence. The present study contributes important findings to the gambling literature, highlighting the role of craving and delay discounting in facilitating the inability to stop within-sessions gambling. These findings may provide evidence that chasers and non-chasers represent two different types of gamblers, and that the difference may be useful for targeting more effective therapies.

Keywords: gambling; problem gambling; gambling disorder; chasing losses; delay discounting; craving

1. Introduction

Despite the diagnostic change of pathological gambling from an impulse control disorder (American Psychiatric Association [APA], 1980) to a behavioral addiction (APA, 2013), chasing losses continues to be recognized as a behavioral marker and a diagnostic criterion for disordered gambling. Chasing has been defined as an "illogical behavior" whereby "people gamble and lose yet continue to gamble in order to *get even*" (Lesieur, 1979; p.79). Chasers experience an irresistible urge to start and to continue in gambling and find it hard to (i) resist the temptation to keep gambling, (ii) reduce the time spent in gambling, (iii) stop before all money is spent, and (iv) refrain from gambling even for one day (O'Connor & Dickerson, 2003). For chasers, rather than act as deterrent, losing financially represents an incentive to gamble in an attempt to recover the money lost – "the more money that is lost, the more intense the *chase*" (Lesieur, 1984, p.xx – page number needed for quote). Moreover, the possibility to increase stake size on gambling activities further impairs cognitive control during gambling, and facilitates a vulnerability for chasing (Parke et al., 2016). Chasing represents a commonly observable behavior among problem gamblers. According to several surveys, approximately 33-40% of regular gamblers report chasing sometimes, whereas the 13% report chasing usually or always (Dickerson, Hinchy, & Fabre, 1987; McBride, Adamson, & Shevlin, 2010; O'Connor & Dickerson, 2003; O'Connor, Dickerson, & Phillips, 1995; Sacco, Torres, Cunningham-Williams, Woods, & Unick, 2011; Toce-Gerstein, Gerstein, & Volberg, 2003).

In the extant literature, several attempts have been made to understand the etiological processes involved in the complex phenomenon of chasing. The first experimental study on chasing was that of Breen and Zuckerman (1999) who devised a task where participants were given £10 (are you sure it was £ and not $? I thought this was an American experiment) that they could keep or bet. Based on their choice, participants were defined as "non-players" (participants who declined to gamble), "chasers" (participants who gambled and lost all money), and "non-chasers" (participants who gambled and quit while they still had some money). The findings demonstrated that impulsivity discriminated chasers from non-chasers but no associations were observed between chasing behavior (the number of trials gambled in the chasing task) and gambling severity or sensation-seeking. In contrast, Linnet et al. (2006), who operationally defined chasing as five consecutive disadvantageous choices in the Iowa Gambling Task (IGT; Bechara, Damasio, Damasio, & Anderson, 1994), observed that pathological gamblers chased more than non-problem gamblers, and that gamblers who chased scored significantly higher than non-chasers on sensation seeking measures. Corroborating and extending Linnet et al.'s (2006) findings, a recent study (Nigro, Ciccarelli, Cosenza, 2018a) observed chasers performing worse than non-chasers on the IGT and found chasing mediated the relationship between decision-making impairment and gambling severity. Chasing has also been associated with low sensitivity to punishment (Kim & Lee, 2011), disinhibition (Nigro et al., 2018b), and increased activation in brain regions related to reward expectation (Campbell-Meiklejohn, Woolrich, Passingham, & Rogers, 2008).

As shown by this brief overview, to date, several lines of evidence have associated different impulsivity features with chasing. However, the relationship between chasing and delay discounting has never been examined. Delay discounting refers to the fact that when gamblers are required to make a choice between a small reward delivered immediately and a larger reward delivered after a delay, they tend to discount the delayed reward option, irrespective of the reward magnitude. The steepness of delay discounting is considered a measure of impulsivity and it has been found to be a strong predictor of problem gambling (Alessi & Petry, 2003; Cosenza & Nigro, 2015; Dixon, Marley, & Jacobs, 2003; Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2006; Mishra & Novakowski, 2016; Petry, 2001; Tabri, Shead, & Wohl, 2017; see Wiehler & Peters [2015] for a review). Delay discounting is particularly relevant to gambling in that it involves impulsive monetary choices that are the core feature of disordered gambling (Bickel & Marsch, 2001). Impulsive monetary decisions are also key factors in chasing, where gamblers, motivated to win money (Lister, Nower, & Wohl, 2016), are prone to taking more risks during play and activating a dangerous spiral where each loss is followed by an increased size of wager to recover the loss, and markedly increasing the severity of gambling involvement (Corless & Dickerson, 1989; Sharpe, 2002).

Apart from winning money and having fun, the motivation underlying chasing behavior by gamblers remains largely unknown. To address this knowledge gap, in the present study investigated the role of craving in loss-chasing behavior. Craving is the strong subjective desire to engage in specific behaviors (such as gambling) and has been demonstrated to contribute importantly to both maintaining and promoting relapse in gambling disorder (e.g., Ashrafioun & Rosenberg, 2012; Blaszczynski & Nower, 2002; Drummond, Litten, Lowman, & Hunt, 2000). According to some addiction theories (e.g., Tiffany & Conklin, 2000; see Drummond, 2001 for a review), the genesis of craving is associated with both positive and negative reinforcement. Positive reinforcement arises via the excitement resulting from gambling, whereas negative reinforcement arises via the relief from negative emotions that gambling provides. Craving is listed among the diagnostic criteria for substance use disorders but not for gambling disorder. This is arguably surprising given that craving is usually a target of psychotherapeutic treatments (Grant, Kim, Hollander, & Potenza, 2008) and that disordered gamblers can experience stronger cravings than alcoholics and cocaine addicts (e.g., Castellani & Rugle 1995; Tavares, Zilberman, Hodgins, & el-Guebaly, 2005). The lack of research attention that the craving construct has received in the gambling literature may be one of the reasons that it is not listed in the criteria for gambling disorder. To the best of the authors' knowledge, only a handful of studies have assessed craving and its relationship with chasing. Among these, Young and Wohl (2009), in the attempt to test the reliability of the Gambling Craving Scale (GACS), observed that the 'Relief' subscale predicted persistence in the face of losses in a simulated slot-machine casino game. In another study examining the priming effect of gambling outcomes on the desire to continue play among healthy and problem gamblers, Young et al. (2008) found that among problem gamblers, the desire to gamble increased after a win but remained stable after a loss.

The aim of the present study was to investigate the interplay between delay discounting, craving, chasing, and gambling by comparing chasers and non-chasers, while controlling for gambling severity. It was hypothesized that compared to non-chasers, chasers would show steep discounting rates and higher levels of craving. It was also hypothesized that delay discounting and craving, along with gambling severity, would predict chasing behavior.

2. Materials and Methods

2.1. Participants and procedure

Of 176 people recruited from several Video Lottery Terminal (VLT) gambling venues, a total of 128 volunteers accepted to participate in the experimental study (rejection rate=27.3%). All participants met the inclusion criteria: (i) gambling once a week or more and (ii) being 18 years of age or over. The sample comprised 94 males (73.4%) and 34 females, with an age range from 18 and 67 years (M_{age}=35.66; *SD*=11.9). Participants were individually tested in a quiet room of the gambling venues where they were screened for problem gambling using the Italian version (Cosenza, Matarazzo, Baldassarre, & Nigro, 2014) of the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). They also completed the Monetary Choice Questionnaire (MCQ; Kirby & Maraković, 1996; Kirby, Petry, & Bickel, 1999) that assesses delay discounting, the Gambling Craving Scale (GACS; Young & Wohl, 2009; translated into Italian by Ciccarelli, Nigro, Griffiths, Cosenza, & D'Olimpio, 2016a) that assesses craving, and performed the ChasIT (Nigro et al., 2018a, 2018b), a computerized task assessing chasing behavior.

All participants gave written informed consent prior to data collection. Each participant was randomly assigned to one of the two conditions of the ChasIT (*control* and *loss*). The experimenter ensured that the participant read and understood the computerized tasks instructions. Once participants began the task, they were left alone at the computer, with the experimenter waiting on the other side of the room until they had finished. When participants indicated that they had finished, the experimenter returned, delivered paper-and-pencil questionnaire (SOGS, MCQ, and GACS) and left the participants alone. The administration order of the self-report questionnaire was balanced between participants. In order to assure that participants did not leave the experimental session with high levels of gambling-related craving or with great willingness to chase, each participant was debriefed after data collection. Here, the specific aims of the study were revealed, the nature of chasing behavior was explained, and any questions regarding the experiment were fully answered. The research team's university ethics committee approved the research protocol.

2.2. Measures

South Oaks Gambling Screen (SOGS): The 20-item SOGS is a self-report instrument where each response is dichotomous (yes/no) and assesses the frequency and the gravity of gambling problems. Items include "*When you gamble, how often you go back another day to win back the money you lost?*" and "*Have people ever criticized your gambling?*" The items are based on the DSM criteria for problem gambling (APA, 1980). Individuals who score from

0-2 are classified as having no problems with gambling, whereas those who score from 3-4 are classified as problem gamblers, and those with a score of 5 or above are classified as pathological gamblers. The SOGS in the present study was found to have a high internal consistency reliability coefficient (Cronbach's alpha = 0.91, 95% CI [0.89, 0.93]).

Monetary Choice Questionnaire (MCQ): The 27-item MCQ assesses delay discounting on a dichotomous scale (yes/no). For each item, participants are required to express a preference between two hypothetical monetary options ($11- $85): a small reward available immediately and a large reward available after a delay ranging from seven days to 186 days. For example, one question asks, "*Would you prefer $14 today, or $25 in 19 days?*" Based on the magnitude of the reward, items are grouped into three categories: small, medium, and large. Participants are instructed to respond in the same manner as they would with real money. The pattern of responses was used to estimate *k* values obtained at three magnitudes of rewards, so determining the degree to which participants discounted delayed rewards. The delay-discounting estimation procedure is described in details by Kirby and colleagues (Kirby & Marakovic, 1996; Kirby et al., 1999). In the present study, money was converted from US dollars to Euros. The Kuder-Richardson reliability for the total scale (KR-20=0.92) and for each scale was adequate in the present sample: small *k* (KR-20=0.75), medium *k* (KR-20=0.77), and large *k* (KR-20=0.79).

Gambling Craving Scale (GACS): The 9-item GACS is a self-report measure that assesses gambling-related craving. Specifically, it assesses three different dimensions of craving: anticipation (e.g., "*Gambling now would make things seem just perfect*"), desire (e.g., "*All I want right now is to gamble*"), and relief (e.g., "*If I were gambling now, I could think more clearly*"). Respondents are required to indicate agreement on a 7-point Likert scale from "strongly disagree" to "strongly agree". In the present study, internal consistency for the total scale (α=0.91, 95% CI [0.89,0.93]) and for each scale was good to excellent: desire (α=0.94, 95% CI [0.93,0.96]), anticipation (α=0.83, 95% CI [0.77,0.87]), and relief (α=0.81, 95% CI [0.75,0.86]).

ChasIT Task: The ChasIT is a computerized task developed with SuperLab 4.0 experimental software that simulates a card game in which participants play against the house. Participants were told that they were gambling on chance-determined game and were given a virtual amount of money (€10) to play with and they were asked to treat it as real money. Each card reported a number ranging from 1 to 9. For each trial, if participants had the highest card won €1 and received positive feedback (*"You won 1 Euro!"*), whereas if they had the lowest card lost the same amount of money and received a negative feedback (*"You lost 1 Euro!"*). Positive and negative feedback were both visual and aural. Unbeknownst to the participants, gambling outcomes were predetermined whereby the rate of winning and losing varied as a function of condition. In the *control condition*, after the first half of the task (30 trials), participants kept the entire budget, whereas in the *loss condition* participants lost €12 (i.e., more than the initial budget). In both the task conditions, participants were allowed to continue or to stop playing the game. For each of the subsequent 30 trials, in both the conditions, participants received positive or negative feedback and were informed about the amount of credit

they had. They then had to decide if they wanted to continue or stop the game by pressing the "M" key to continue playing or the "Z" key to stop playing. In the control condition, the final budget was €10, and in the loss condition minus €14. The number of wins and losses varied as function of condition (15 and 15 in the first and second part of the control condition, and 9 and 21 in the loss condition) but the sequence was the same for each condition. Participants who chose to stop playing at the beginning of the second phase of the computerized task were classified as "non-chasers", whereas participants who decided to continue playing were classified as "chasers". Chasing task performance measures included the decision to chase/quit gambling and the number of trials played (chasing persistence).

2.3. Statistical analyses

All data analyses were conducted using SPSS version 20.0, with the alpha significance level at p=.05. Bivariate correlations were computed to examine associations among variables of interest. To evaluate differences between groups, chi-square test for categorical data and analysis of variance for quantitative data were used. Linear and logistic regression analyses on decision to chase and chasing frequency were also conducted, while controlling for multicollinearity. In the present study, the variance inflation factor (VIF) was below the recommended cut-off of 10 (Ryan, 1997), supporting no issues with multicollinearity.

3. Results

Correlational analysis (Table 1) showed a strong pattern of associations between gambling severity, decision to chase, chasing frequency, steep discounting rates, and craving levels. Furthermore, both the decision to chase and the number of trials played in the chasing task were positively correlated with both delay discounting and craving. The negative association between gender and all the variables indicated that severe gambling involvement, high discounting rates, and craving levels correlated with male gender.

INSERT TABLE 1 ABOUT HERE

According to SOGS scoring, the sample comprised 58 non-problem gamblers, 18 problem gamblers, and 52 pathological gamblers. Non-problem gamblers comprised 53.4% males with an age average of 35.34 years (SD=12.9), problem gamblers comprised 89% males with an age average of 33.11 years (SD=8.85), and pathological gamblers comprised 90% males with an age average of 36.9 years (SD=11.69). Analyses showed differences in gender ($\chi^2(2)=21.74$; $p<.001$) but not in age ($F_{2,125}= 0.71$; p=.49) among the SOGS groups, with non-problem gambling group having high proportion of female participants. Table 2 shows the frequency of participation in each gambling activity during the last year.

To compare SOGS groups on chasing frequency, a repeated measures ANCOVA was performed, with group as between-participants factor, the number of trials played after the decision to chase as dependent variable, and gender

as a covariate. From the analysis, a main effect of group ($F_{2,124}$=18.88; p<.001; η^2_p=.23) emerged, with pathological gamblers chasing for significantly more trials than non-problem and problem gambling counterparts (all p-values <.01), without any effect of gender ($F_{1,124}$=2.66; p=.1).

INSERT TABLE 2 ABOUT HERE

Participants were randomly assigned to one of two conditions of the ChasIT task. The group in the control condition comprised 39% males with an age average of 34.91 years (*SD*=11.6) and a SOGS mean score of 4.8 (*SD*=4.93), whereas the group in the loss condition comprised 34% males with an age average of 36.42 years (*SD*=12.24) and a SOGS mean score of 4.83 (*SD*=5.06). Analyses showed that participants in control and loss conditions of the ChasIT task were homogeneous in terms of gender ($\chi^2(1)$=1.44; p=.23), age ($F_{1,126}$= 0.52; p=.47), and SOGS scores ($F_{1,126}$= NS). The effect of task conditions (control vs. loss) on chasing behavior was controlled for. Analyses showed that the assignment to one of the two conditions did not affect either the decision to continue ($\chi^2(1)$= NS) or chasing frequency ($F_{1,126}$=2.35; p=.13).

Of the total sample, 56.3% decided to continue gambling in the second half of the ChasIT task for an average number of 7.27 trials played (*SD*=10.42). Based on the decision to chase, participants were divided into two groups: chasers and non-chasers. Analyses showed that these groups did not differ on age ($F_{1,126}$=0.52; p=.47) but did on gender ($\chi^2(1)$=13.55; p<.001) and SOGS scores ($F_{1,126}$=37.40; p<.001; η^2_p=.23). Chasers reported more problem gambling than non-chasers. Moreover, female participants were less prone to chase. All subsequent analyses were therefore performed controlling for gender and gambling severity.

Chasers and non-chasers were compared on delay discounting and craving scores. The ANCOVA performed on the MCQ subscales, using decision to chase as a group variable, and controlling for both SOGS scores and gender, showed significant main effects of both reward magnitude ($F_{2,123}$=3.96; p=.02; η^2_p=.06) and SOGS scores ($F_{1,124}$=36.64; p<.001; η^2_p=.23). However, no effect of chasing group ($F_{1,124}$=0.08; p=.77) or gender ($F_{1,124}$=0.04; p=.83) were found. No interaction of reward magnitude with decision to chase ($F_{2,123}$=0.02; p=.98), SOGS scores ($F_{2,123}$=0.91; p=.40), and gender ($F_{2,123}$=0.13; p=.88) were found. These analyses suggested that chasers and non-chasers did not differ in the discounting rates after controlling for gambling severity.

The same ANCOVA performed on the GACS subscales, using decision to chase as a group variable, and controlling for both SOGS scores and gender, yielded main effects of craving ($F_{2,123}$=78.75; p<.001; η^2_p=.56), group (chasers vs. non chasers) ($F_{1,124}$=7.29; p<.01; η^2_p=.06), SOGS ($F_{1,124}$=103.04; p<.001; η^2_p=.45), and gender ($F_{1,124}$=6.58; p=.01; η^2_p=.05), and significant interaction between craving and gender ($F_{2,123}$=4.08; p=.02; η^2_p=.06). The interactions of craving with decision to chase ($F_{2,123}$=0.53; p=.59) and SOGS scores ($F_{2,123}$=1.67; p=.19) were non-significant. The results indicated that chasers, as compared to non-chasers, reported high levels of craving. This difference remained

significant even after controlling for gambling severity. Moreover, males scored higher than females on craving. Table 3 summarizes the test scores of chasing groups (chasers vs. non-chasers).

INSERT TABLE 3 ABOUT HERE

To evaluate the contributions of gender, age, chasing task condition, SOGS scores, MCQ average *k*, and GACS subscales to chasing, a hierarchical logistic regression analysis was conducted, using decision to chase as the criterion variable. The results of the final regression model indicated that Relief subscale of GACS and SOGS scores significantly predicted chasing decision (χ^2[2, N=108]= 40.76; p<.001). The overall model explained 37% of variance (Nagelkerke R_2). The overall classification accuracy was 73.4% (see Table 4).

INSERT TABLES 4 AND 5 ABOUT HERE

A hierarchical linear regression analysis was also carried out on ChasIT total score (chasing persistence), with gender, age, chasing task condition, SOGS scores, MCQ average *k*, and GACS subscales as independent variables. SOGS and *k* total scores emerged as significant predictors of chasing frequency, with the overall model explaining more than one-third of the total variance (R^2_{adj}=.37; $F_{2,127}$=38.67; p<.001) (Table 5).

4. Discussion

The focus of this study was to experimentally examine – for the first time – the role of delay discounting and craving in chasing behavior, controlling for gambling severity. To assess chasing behavior, a valid computerized task (the ChasIT; Nigro et al., 2018a) was utilized. The ChasIT is a card game where participants can decide whether to chase or to quit gambling. In the control condition, the number of wins and losses was the same; in the loss condition, participants lost more than their starting budget. Consequently, the role of gambling outcomes on chasing can be ascertained. Both decision to chase and chasing persistence (namely, the number of trials played) were considered as dependent variables. The ChasIT mainly investigates within-session chasing. Although the DSM-5 (APA, 2013) refers to chasing as "often returns another day to get even" (between-session chasing), researchers have demonstrated that the between-session and within-session chasing are highly correlated (Nigro et al., 2018a; Parke et al., 2016), so concluding that "a 'within-session' conceptualization is a useful point of departure for understanding the individual determinants of chasing" (Breen & Zuckerman, 1999; p. 1098).

In the present study, participants were randomly assigned to the loss or control condition of the ChasIT and analyses demonstrated that the two groups were homogeneous for demographic characteristics (gender and age), and gambling severity. Interestingly, the task condition did not affect chasing behavior. In other words, participants bet irrespective of their prior experience of winning or losing. Few studies have experimentally assessed differences in chasing behavior after wins or losses. The results of the present study are in line with some previous studies (e.g., Lister et al., 2016; Nigro et al., 2018b), but in contrast with others (e.g., Breen & Zuckerman, 1999; O'Connor & Dickerson,

2003). There may be different reasons for these conflicting results. Among these is the possibility that the relationship between gambling outcomes and chasing is mediated by stake size (Parke et al., 2016) that has been showed to be important in promoting chasing.

Findings in the present study demonstrated that pathological gamblers, as compared to problem and non-problem gambling counterparts, were more prone to chase and to persist in chasing. These findings concur with previous studies that similarly found chasing losses to be a discriminator of problem gambling, because it increases as function of gambling involvement (Corless & Dickerson, 1989; Dickerson, 1991; Linnet et al., 2006; Lister et al., 2016; Nigro et al., 2018a; Stinchfield, Govoni, & Ron Frisch, 2005). However, Breen and Zuckerman (1999) failed to find such a relationship. The sample in their study comprised young male undergraduates aged 18 and 19 years old, with an average SOGS score of 1.9, whereas the sample in the present study comprised adult participants with an average SOGS score of 4.81. Therefore, the discrepancy between the levels of gambling severity could potentially account for these contrasting results.

The negative association of gender with chasing suggests that males are more willing to chase losses than females. Although the majority of studies assessing chasing behavior have not examined gender differences (Bibby, 2016; Breen & Zuckerman, 1999; Campbell-Meiklejohn et al., 2008; Kim & Lee, 2011; Lister et al., 2016; Parke et al., 2016) or have not found gender differences (O'Connor & Dickerson, 2003; Worhunsky, Potenza, & Rogers, 2017), the results of the present study are in line with previous studies that have reported more persistent chasing behavior among male gamblers (Linnet et al., 2006; Nigro et al., 2018a, 2018b). Male gender was also associated with steep discounting rates and high craving levels, probably due to the high prevalence of problem gambling among males compared to the female population (Cosenza et al., 2014; Cosenza, Ciccarelli, & Nigro, 2018, 2019; Cosenza & Nigro, 2015; Hing, Russell, Tolchard, & Nower, 2016; Nigro, Cosenza, & Ciccarelli, 2017).

The results also indicated that the association between decision to chase and delay discounting did not remain significant after controlling for gambling severity. However, as the regression analysis showed, delay discounting predicted chasing persistence. Overall, these results corroborate previous studies which have reported problem gamblers as being significantly less likely to tolerate delay in gratification compared to non-problem gamblers (Parke, Griffiths & Irwing, 2004), and consequently more prone to devalue rewards that involve a delay, even if larger than those immediately achievable (Ciccarelli, Malinconico, Griffiths, Nigro, & Cosenza, 2016; Cosenza, Griffiths, Nigro, & Ciccarelli, 2017; Miedl, Peters, & Büchel, 2012; Kräplin et al., 2014). The present findings suggest that delay discounting appears to be a determinant of within-session chasing, but not of decision to chase. This finding has never been documented in the gambling studies literature previously

Chasers showed higher levels of craving as compared to non-chasers. Chasers gamble for the pleasure derived from gambling activities, for the expectations of fun and, above all, for the relief from negative emotions that gambling

allays (Ciccarelli et al., 2016a, 2016b). Moreover, relief emerged as a strong predictor of the decision to chase, as in a previous study, in which all the GACS subscales predicted gambling persistence but when the shared variance among the scales were controlled for, only the Relief subscale remained a significant predictor (Young & Wohl, 2009). Gambling losses, or not winning enough, require gamblers to manage negative emotions such as frustration and anger (O'Connor & Dickerson, 1997). A great deal of evidence supports the existence of an emotional vulnerability among gamblers, who usually experience high levels of negative affect, due to the lack of emotional awareness (Bagby et al., 2007; Blaszczynski & Nower, 2002; Ciccarelli, Griffiths, Nigro, & Cosenza, 2017; Cosenza, Baldassarre, Matarazzo, & Nigro, 2014; Navas, Verdejo-García, López-Gómez, Maldonado, & Perales, 2016; Williams, Grisham, Erskine, & Cassedy, 2012; Wood & Griffiths, 2007). Further support for the relevance of the present study's results are previous findings suggesting that gamblers may chase to cope with negative emotions (or lack of positive experiences) (Bibby, 2016; Campbell-Meiklejohn et al., 2008; Elman, Tschibelu, & Borsook, 2010; Ferguson et al., 2009).

Some limitations of the present study should be noted when interpreting the findings. First, female participants represented only one-third of the total sample. Given the role of gender in gambling, future studies should correct this imbalance. Secondly, the predetermined amounts of wagers may not have been attractive enough to affect chasing. Indeed, it has been demonstrated that big and small wins can exert different influences on gambling motivations (Young et al., 2008). Third, given that the main motivation both to gamble and to chase is winning money (Lister et al., 2016), it is possible that larger bets may have more ecological validity. Moreover, the ChasIT did not include a win condition. As previous theoretical (Blaszczynski & Nower, 2002) and empirical (e.g., Young et al., 2008) contributions have shown, the role of winning in facilitating chasing cannot be ignored. Finally, chasing behavior was assessed using virtual money. Although studies evaluating the role of the type of rewards (real vs. non-real) on several gambling-related behaviors (i.e., decision-making and delay discounting) have reported mixed results (e.g., Fernie & Tunney, 2006; Johnson & Bickel, 2002; Lagorio & Madden, 2005; Weinberg, Riesel & Proudfit, 2014), this could represent a limitation that need to be taken into account when interpreting the present findings. Future studies would benefit from addressing the limitations of the present study especially regarding the role of wins in chasing behavior. In addition, it would be helpful to examine chasing behavior taking into account the preferred gambling activity, as well as evaluating the role of chasing in promoting disordered gambling in adolescent populations.

5. Conclusions

The present study examined the previously unexplored relationship of delay discounting and craving with chasing behavior (controlling for gambling involvement) and demonstrated that the heightened levels of craving and the inability to tolerate delays in gratification appear to have a role in the decision to chase losses and in chasing persistence, respectively. The present findings make an important contribution to the gambling literature, highlighting

that these two different aspects of chasing may have different underlying mechanisms (for similar results, see Nigro et al., 2018b) and that, taken together, craving and delay discounting might undermine the ability to stop gambling within-session. In order to implement effective strategies, psychotherapeutic interventions are recommended which consider the possibility that chasers and non-chasers represent two gambling subtypes that differ in terms of motivation, behavior, and severity.

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