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Chasing the desire: An investigation on the role of craving, time perspective, and alcohol use in adolescent gambling

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HIGHLIGHTS

- The study investigated the role of craving, time perspective, gambling severity, and alcohol use in chasing.
- A sample of 364 adolescents took part in the study.
- Craving predicted the decision to chase.
- Craving and alcohol consumption were good predictors of chasing persistence.
- Gambling severity did not predict either the decision to chase or chasing frequency.

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ABSTRACT

Chasing, or continuing to gamble to recoup losses, is a behavioral marker and a diagnostic criterion for gambling disorder. Research on chasing has focused mainly on adults, whereas the analysis of chasing behavior among adolescents has not received empirical attention in the gambling literature. The aim of the present study was to first investigate the interplay between chasing behavior, craving, temporal perspective, alcohol use, and gambling severity among Italian adolescents. Three hundred and sixty-four adolescents took part in the study. Participants completed the South Oaks Gambling Screen Revised for Adolescents (SOGS-RA), the Gambling Craving Scale (GACS), the 14-item Consideration of Future Consequences scale (CFC-14), the Alcohol Use Disorders Identification Test (AUDIT), and performed a computerized task assessing chasing behavior. Participants were randomly assigned to the control and the loss condition of the computerized task. Results indicated that the choice to continue playing, as well as chasing frequency did not vary as a function of experimental condition. Hierarchical logistic and linear regression analyses revealed that the decision to chase depended mostly on craving, whereas chasing propensity was affected by craving and alcohol misuse. Notably, gambling severity did not predict either the decision to chase, or the chasing persistence. The present study contributes important findings to the gambling literature, highlighting the role of craving alcohol use in facilitating the inability to stop within-sessions gambling among adolescents. These findings may provide evidence that nonchasers and chasers represent two different types of gamblers, and that the difference may be useful for targeting more effective therapies.

1. Introduction

Chasing involves continuing gambling to recoup previous losses (Lesieur, 1979, 1984). Since the publication of the third edition of the Statistical Manual of Mental Disorders (DSM-III-R; American Psychiatric Association [APA], 1987) chasing losses represents a behavioral marker and a defining feature of disordered gambling, as well as a hallmark of the transition from recreational to disordered gambling

(Zhang & Clark, 2020).

Chasing is so common in gambling disorder (e.g., McBride, Adamson, & Shevlin, 2010; O'Connor & Dickerson, 2003; Sacco, Torres, Cunningham-Williams, Woods, & Unick, 2011) that 75.9% of problem gamblers chase (Toce-Gerstein, Gerstein, & Volberg, 2003). Chasing is a useful criterion for identifying at-risk gamblers, since, "all other factors being equal, increased chasing behavior is related to greater gambling involvement, which could potentially generate problems relating to a

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significant frequency and expenditure of money spent on gambling activities” (Yakovenko, Fortgang, Prentice, Hoff, & Potenza, 2018, p. 381). Although according to DSM, chasing implies returning on a later day to recoup lost money, chasing is not confined, as DSM criteria might suggest, to between-session chasing since it also refers to the tendency to gamble too long within a particular session (within-session chasing; Breen & Zuckerman, 1999, p. 1080).

The extant literature has demonstrated that chasing is an important step in the development and maintenance of gambling disorder (for reviews, see Nigro, Ciccirelli, & Cosenza, 2018b; Nigro, Matarazzo, Ciccirelli, D'Olimpio, & Cosenza, 2019; Zhang & Clark, 2020), is one of the few observable signs for disordered gambling (Gainsbury, Suhonen, & Saastamoinen, 2014), and the only criterion of gambling addiction absent in substance use disorder (Quester & Romanczuk-Seiferth, 2015).

Previous research found that chasing is associated, among others, with impulsivity (Breen & Zuckerman, 1999), sensation seeking (Linnet, Røjskjær, Nygaard, & Maher, 2006), increased activation in brain regions related to reward expectation (Campbell-Meiklejohn et al., 2008), low sensitivity to punishment (Kim & Lee, 2011), poor decision-making (Nigro, Ciccirelli, & Cosenza, 2018a), disinhibition (Nigro et al., 2018b), alexithymia (Bibby, 2016), deficit in mentalization (Nigro et al., 2019), and heightened levels of craving (Ciccirelli, Cosenza, D'Olimpio, Griffiths, & Nigro, 2019b). Importantly, recent research provided evidences that chasers and nonchasers represent two distinct subgroups of gamblers, over and above gambling severity (Ciccirelli, Cosenza, Griffiths, D'Olimpio, & Nigro, 2019a; Ciccirelli et al., 2019b; Nigro et al., 2018a, 2018b, 2019; see also Linnet et al., 2006). Moreover, a recent contribution reported a significant association between craving and shortened time horizon (Ciccirelli et al., 2019a), showing that chasers differ significantly from nonchasers in terms of temporal perspective, with chasers being more focused on the present rather than to the future consequences of their behavior.

As the gambling literature shows, research concerning chasing behavior has focused mainly on adults. The paucity of studies examining chasing in adolescence is quite surprising, not only because gambling activities via smartphone and other similar devices among adolescents increased over the last decade (King, Russell, & High, 2020), but also because several studies demonstrated that, other things being equal, severe gambling-related problems in adulthood stem from early engagement in gambling (Blaszczynski & Nower, 2002; Blinn-Pike et al., 2010; Volberg, Gupta, Griffiths, Olason, & Delfabbro, 2010; Olason et al., 2011; Cosenza et al., 2014; Gupta & Derevensky, 2014; for a review, see Calado, Alexandre & Griffiths, 2017).

According to Campbell-Meiklejohn et al. (2008), loss chasing shows the expectancy of later positive outcomes and the decision to chase looks similar, at neural level, to a craving for a drug among addicts. As their findings suggest, “the decisions to chase are mediated by activity in systems that code positive incentive-value and powerful appetitive states and that dysfunction in these circuits mediates the excessive urge to chase reported by pathological gamblers” (p. 297). In this perspective, there is a strong association between the attempt to regain larger amounts of money previously lost in the gamble by increasing stakes (loss chasing) and craving, that is an intense desire to engage in addictive behaviors.

Specifically, craving is the strong subjective desire to engage in specific behaviors (such as gambling) and has been suggested 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; see also Heinz & Beck, 2019). According to some addiction theories (e.g., Tiffany & Conklin, 2000; see also Drummond, 2001 for a review), the genesis of craving is associated with positive as well as with negative reinforcement. Positive reinforcement stems from the excitement resulting from gambling, where negative reinforcement arises via the relief from negative emotions that gambling provides. Although craving

is usually a target of psychotherapeutic treatments for disordered gambling (Grant, Kim, Hollander, & Potenza, 2008) and even if disordered gamblers can experience stronger cravings than alcoholics and cocaine addicts (e.g., Castellani & Rugle, 1995; Tavares, Zilberman, Hodgins, & el-Guebaly, 2005), craving is one of the diagnostic criteria for substance use disorders but, quite surprising, not for gambling disorder.

The few studies exploring the association between chasing and craving found, among others, that the relief associated with gambling predicted persistence in the face of losses in a simulated slot-machine casino game (Young & Wohl, 2009), that the desire to gamble increased after positive gambling outcomes among problem gamblers (Young, Wohl, Matheson, Baumann, & Anisman, 2008), and that heightened levels of craving predicted both the decision to chase and chasing persistence (Ciccirelli et al., 2019b).

Considering that the DSM-5 (APA, 2013) has added craving as a new criterion and changed the diagnostic structure of alcohol use disorder (AUD) and that alcohol and gambling problems show high co-occurrence among both adults and adolescents (e.g., Barnes, Welte, Hoffman, & Tidwell, 2009; Nigro & Cosenza, 2016; Tackett et al., 2017; for reviews, see Rahman et al., 2014; Rash, Weinstock, & Van Patten, 2016), the aim of the present study was to first investigate the interplay between chasing behavior, craving, temporal perspective, alcohol use, and gambling severity among Italian adolescents. Consistent with previous studies on adolescents demonstrating a strong association between gambling severity and weak concern for the long-term consequences of engaging in the behavior (for a review, see Cosenza, Ciccirelli & Nigro, 2019b) and in line with recent findings on adults (Ciccirelli et al., 2019b), we expected that, compared to nonchasers, chasers would show higher levels of craving and shortened time horizon. Furthermore, as chasing behavior and craving were found to be associated with alcohol misuse (Ciccirelli, Nigro, Griffiths, D'Olimpio, & Nigro, 2020; Nigro et al., 2019; O'Connor & Dickerson, 2003), we expected that higher levels of alcohol consumption would be associated with higher levels of craving and chasing proneness. Specifically, it was hypothesized that, along with gambling severity, craving, present orientation, and alcohol consumption would predict chasing behavior. Finally, in line with Young et al.'s findings (2008), we expected that the desire to gamble would decrease after a series of persistent and repeated losses.

2. Materials and methods

2.1. Participants

Three hundred and sixty-four adolescents (45.9% boys) aged between 13 and 19 years ($M_{\text{age}} = 17.03$ years; $SD = 2.07$) attending eight different public high schools (61.1% lyceums and 38.9% technical and trade schools) in Southern Italy participated in the study. Data were collected from September 2019 to January 2020, that is before Italy's Covid-19 lockdown. The only inclusion criteria were attending high school and be willing to take part in the study after being informed of all aspects of the study that might influence the decision to participate. All participants gave written informed consent prior to data collection. For minors, informed consent was obtained from parents. The Ethics Committee of the research team's University Department approved the present study. Participants were tested individually in a quiet room at school. Participants did not receive anything for participating in the study. As chasing task had two conditions (Control and Loss) an equal number of participants ($N = 182$) was randomly assigned to each condition following block randomization procedure. Participants did not receive anything for participating in the study. For each paper-and-pencil measure participants received detailed written instructions. Participants could ask any questions about the questionnaires, if any. No student refused to participate in the study.

2.2. Procedure and measures

Participants were administered the South Oaks Gambling Screen Revised for Adolescents (SOGS-RA; Winters, Stinchfield, & Fulkerson, 1993; Italian version: Colasante et al., 2013) to assess adolescent gambling problems, the Gambling Craving Scale (GACS; Young & Wohl, 2009; translated into Italian by Ciccarelli, Nigro, Griffiths, Cosenza, & D'Olimpio, 2016) that assesses craving, the 14-item Consideration of Future Consequences scale (CFC-14; Joireman, Shaffer, Balliet, & Strathman, 2012; Italian validation: Nigro, Cosenza, Ciccarelli, & Joireman, 2016) to assess time perspective, the Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993) that assess alcohol consumption, drinking behaviors, and alcohol-related problems, and performed the ChasIT (Nigro et al., 2018a, 2018b), a computerized task assessing chasing behavior. The questionnaires were administered in counterbalanced order. The administration of the instruments required from a minimum of about 35 min to a maximum of about 50 min. For each condition, half of the participants completed the computerized task at the beginning of the session, the other half at the end. In such a way, the (potential) influence of the experimental task on the paper-and-pencil measures, and vice versa, was balanced. The SOGS-RA is the most widespread self-report instrument for assessing the prevalence of problem gambling in adolescence. It consists of twelve scored items assessing gambling behavior and gambling related problems during the previous 12 months. The total score ranges from 0 to 12. The un-scored SOGS-RA items request participants to indicate, among others, the frequency of participation in different gambling activities, the largest amount of money gambled in 1 day, and parental involvement in gambling. In addition, we asked participants to specify the primary motives for gambling from a list (Volberg, 1993). The Italian version of the SOGS-RA was found to have acceptable internal reliability ($\alpha = 0.78$; Colasante et al., 2013). For the present study the Cronbach's alpha was 0.77.

The GACS is a 9-item scale that assesses gambling-related craving. It includes three dimensions: Anticipation (i.e., the expectation that gambling would be fun), Desire (i.e., an urgent desire to gamble), and Relief (i.e., the expectation that gambling would alleviate negative emotional states). Responses to questions are given on a 7-point Likert scale anchored at 1 (strongly disagree) and 7 (strongly agree). A preliminary confirmatory analysis (CFA) was carried out to test the factor structure of the GACS in a different sample of 323 adolescents (43.7% boys), aging between 13 and 19 years ($M_{age} = 17.01$ years; $SD = 2.02$). CFA was conducted with the EQS 6.2 software program for structural equation modeling (Bentler, 2008). Results indicated that the original three-factor model fit well the data ($\chi^2 / df = 2.42$; RMSEA = 0.066 (95% CI = 0.055–0.088); SRMS = 0.039; CFI = 0.975, GFI = 0.963). For the present study, the Cronbach's alphas were 0.69 (Anticipation scale), 0.91 (Desire scale), and 0.68 (Relief scale).

The CFC-14 measures individual differences in the extent to which people weigh the immediate as opposed to distant implications of current behaviors and events. Responses are made with a 7-point Likert scale ranging from 1 (extremely uncharacteristic of me) to 7 (extremely characteristic of me). Items are equally divided into two subscales: Immediate (CFC-I) that concerns orientation toward the present, and Future (CFC-F) that concerns the consideration of the future consequences of actual behavior. The Cronbach's alphas for the Immediate and Future scales were 0.84 and 0.83, respectively, in a large sample of Italian adolescents (Nigro, Cosenza, Ciccarelli, & Joireman, 2016). For the present study the Cronbach's alphas were 0.87 (Immediate Scale) and 0.75 (Future scale), respectively.

The AUDIT is a 10-item measure of alcohol consumption, drinking behavior, and alcohol-related problems. It comprises three questions concerning the amount and frequency of drinking alcohol, three questions concerning alcohol dependence, and four questions concerning problems caused by drinking alcohol. Participants respond to each question on a 5-point scale. A score of 8 or more indicates a strong

likelihood of harmful alcohol use. In the present study the Cronbach α value was 0.84.

The ChasIT simulated a card game in which participants played against the house. The starting amount of money was 10 Euros and participants were encouraged to treat the play budget as real money. Each card reported a number ranging from 1 to 9. Participants won 1 Euro if they had the highest card. Otherwise, they lose the same amount of money. In both cases, participants received a positive ("You won 1 Euro!") or a negative ("You lost 1 Euro!") feedback on the computer screen and heard a sound, that varied according to the outcome. After the first 30 trials, participants were informed about the amount of money they had saved or lost and had to decide if they wanted continuing or stopping the game. In the control condition participants saved the entire budget, whereas in the loss condition they lost 12 Euros, namely the entire budget plus 2 Euros). Notwithstanding this deficit, the participants were permitted to continue. In the second phase of the task participants received a positive or negative feedback after each trial and were informed about the amount of residual credit. For each trial participants had to decide if they wanted continuing or stopping the game. Since participants could continue playing up to the end, the chasing maximum total score was 30. In the control condition the final budget was 10 Euros, in the loss condition minus 14 Euros. The number of wins and losses varied as function of condition (15 and 15 in the first and second part for the control condition and 9 and 21 in the loss condition). The two blocks of wins and losses were randomized, but the sequence was the same for each participant assigned to that condition. Participants who chose to stop gaming at the beginning of the second phase of the task were classified "nonchasers" (0), whereas those who decided to continue gaming were classified "chasers" (1). The decision to continue play or to stop it, as well as the number of trials played were the two dependent measures of interest.

3. Statistical analyses

All data analyses were conducted using IBM SPSS version 20.0. The alpha level was set at $p = .05$. All variables were initially screened for missing data, distribution abnormalities, and outliers (Tabachnick & Fidell 2013). Because the distributions of the SOGS-RA and the GACS subscales were positively skewed, square root transformation was performed on this variable so that assumptions of normality, linearity and homoscedasticity had been adequately met.

Pearson correlation coefficients and partial correlations were calculated to examine the relationships among SOGS-RA, CFC-14 and GACS subscales, AUDIT, and chasing total scores. For categorical data (gender and experimental condition) differences were compared with the chi-square test. Analysis of variance was used to assess mean differences on continuous variables. The independent associations between gender, age, SOGS-RA, CFC-14 and GACS subscales, AUDIT scores, and the decision to chase were analyzed using hierarchical logistic regression. To reveal potential predictors of chasing frequency, we performed a hierarchical linear regression analysis with ChasIT total score as the dependent variable and gender, SOGS-RA, CFC-14 and GACS dimensions, and AUDIT scores as independent variables. To control for the presence of multicollinearity, before interpreting the regression coefficients, we calculated the variance inflation factors (VIF), which were below the recommended cutoff of 10 (Ryan, 1997).

4. Results

Means and standard deviations on variables of interest by experimental condition and gender are summarized in Table 1. For ease of interpretation, descriptive statistics are reported for the untransformed variables. In accordance with Winters et al.'s original SOGS-RA scoring system (Winters et al., 1993; Winters, Stinchfield, & Kim, 1995), respondents were classified in the following three categories: non-problem gamblers (score of 0–1), at-risk gamblers (score between 2 and 3),

Table 1
Means and standard deviations by experimental condition and gender.

Gender	Control condition (N = 182)				Loss condition (N = 182)			
	Males (N = 89)		Females (N = 93)		Males (N = 78)		Females (N = 104)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
SOGS-RA ^a	1.74	2.24	0.38	0.79	1.73	2.24	0.46	0.81
GACS ^b								
Anticipation	3.03	1.61	2.25	1.33	2.92	1.37	2.30	1.24
Desire	1.44	1.05	1.18	0.74	1.35	0.88	1.11	0.39
Relief	1.90	1.06	1.45	0.94	1.82	0.99	1.37	0.77
CFC-14 ^c								
Immediate	20.12	7.08	18.38	7.68	21.65	8.09	18.93	6.97
Future	31.42	6.91	30.45	7.71	30.05	8.49	31.17	8.12
AUDIT ^d	4.80	5.43	2.74	4.58	5.63	5.52	3.00	3.77
Chasing frequency	2,30	5,95	1,27	3,20	2,32	6,37	1,31	4,52

^a South Oaks Gambling Screen Revised for Adolescents – Untransformed score.

^b Gambling Craving Scale - Untransformed scores.

^c Consideration of Future Consequences scale.

^d Alcohol Use Disorders Identification Test.

and problem gamblers (score of 4 or more). Of the total sample, 77.2% were screened as non-problem gamblers, 15.1% as at-risk gamblers, and 7.7% as problem gamblers. The preferred gambling activities among the participants were cards (54.1%), lotto or lottery games (50.3%), and sports betting (40.7%).

Preliminarily, to ascertain whether participants assigned to the two different experimental conditions differed in terms of gender, age, SOGS-RA, GACS, CFC-41 and AUDIT scores, data were submitted to chi-square test or univariate ANOVA. No effects were observed (all *ps* ns).

To test for gender differences data were submitted to univariate ANOVAs. With the only exception of CFC-14 Future subscale and chasing frequency (*ps* ns), effects of gender were observed on SOGS-RA ($F_{1,362} = 61.79; p < .001; \eta_p^2 = 0.160$), GACS Anticipation ($F_{1,362} = 23.77; p < .001; \eta_p^2 = 0.062$), GACS Desire ($F_{1,362} = 10.57; p < .001; \eta_p^2 = 0.028$), GACS Relief ($F_{1,362} = 25.42; p < .001; \eta_p^2 = 0.066$), CFC-14 Immediate ($F_{1,362} = 7.70; p < .01; \eta_p^2 = 0.021$), and AUDIT scores ($F_{1,362} = 20.83; p < .001; \eta_p^2 = 0.054$), with males outperforming females.

Pearson's correlation coefficients indicated that chasing frequency was significantly positively associated with SOGS-RA ($r = 0.27, p < .01$), GACS (Anticipation: $r = 0.44, p < .01$; Desire $r = 0.44, p < .01$; Relief $r = 0.30, p < .01$), CFC-14 Immediate ($r = 0.19, p < .01$), and AUDIT scores ($r = 0.31, p < .01$). Notably, the associations between chasing proneness, craving, present orientation, and alcohol consumption remained significant even after partialling out gender, age, and SOGS-RA scores (see Table 2).

To verify if the choice to continue or to stop playing varied as a function of experimental condition, data were submitted to Chi-square test. The results showed no significant effect [$\chi^2(1, N = 364) = 0.62; p = .50$; Cramér's $V = 0.41$].

Analyses of variance indicated that relative to nonchasers, chasers

Table 2
Correlation coefficients among variables after partialling out gender, experimental condition, and SOGS-RA scores.

	2	3	4	5	6	7
1. GACS Anticipation	344**	330**	178**	−092	195**	319**
2. GACS Desire	−	497**	182**	−023	073	354**
3. GACS Relief	−	−	216**	004	037	224**
4. CFC-14 Immediate	−	−	−	−002	034	106*
5. CFC-14 Future	−	−	−	−	−069	−030
6. AUDIT	−	−	−	−	−	209**
7. Chasing	−	−	−	−	−	−

Note. * $p < .05$; ** $p < .01$.

reported higher scores on the SOGS-RA ($F_{1,362} = 24.22; p < .001; \eta_p^2 = 0.063$), the GACS scales [Anticipation ($F_{1,362} = 88.53; p < .001; \eta_p^2 = 0.197$); Desire ($F_{1,362} = 45.03; p < .001; \eta_p^2 = 0.111$), Relief ($F_{1,362} = 19.18; p < .001; \eta_p^2 = 0.050$), the CFC-14 Immediate dimension ($F_{1,362} = 4.51; p < .01; \eta_p^2 = 0.012$), and the AUDIT ($F_{1,362} = 19.48; p < .001; \eta_p^2 = 0.051$), with chasers outperforming nonchasers.

To assess the relative contribution of gender (step 1), craving (GACS scores), time perspective (CFC-14 scores), alcohol consumption (AUDIT scores), and gambling severity (SOGS-RA scores; step 2) for the choice to chase, a hierarchical logistic regression analysis was conducted, using the two groups (chasers and non-chasers) as the criterion variable. The results of the final regression model showed that scores on the GACS subscales Anticipation and Desire were significant predictors of the choice to chase (Table 3) Importantly, SOGS-RA scores did not predict chasing propensity.

To identify the potential predictors of chasing frequency, gender (step 1), and scores on SOGS-RA, GACS, CFC-14, and AUDIT (step 2) were input to a hierarchical multiple regression analysis (stepwise method). The results (see Table 4) showed that GACS Anticipation, GACS Desire and AUDIT scores were significant predictors of chasing frequency ($R_{adj}^2 = 0.24, F_{5, 358} = 30.02, p < .001$). Notably, SOGS-RA scores failed to predict the choice to continuing or stop playing.

Hierarchical linear regression (stepwise method) was also used to examine the relationships between gender (step 1), chasing, craving, time perspective, and alcohol consumption as independent variables (step 2) and SOGS-RA (as the dependent measure) to identify predictors of gambling severity (see Table 5). Results indicated that male gender, high scores on the GACS Desire and Anticipation dimensions, the CFC-14 Immediate subscale, and the AUDIT were significant predictors of gambling severity ($R_{adj}^2 = 0.46, F_{5, 358} = 63.27, p < .001$). Interestingly, chasing frequency did not contribute significantly in the model.

5. Discussion

This study first empirically investigated the interplay between within-session chasing, craving, time perspective, and alcohol use in a sample of adolescents. As expected and consistent with previous research on both adults and adolescents (e. g. Cosenza et al., 2019a; Hing, Russell, Tolchard, & Nower, 2016; Nigro et al., 2017; Raylu, Oei, Loo, & Tsai, 2016; Welte, Barnes, Tidwell, Hoffman, & Wieczorek, 2015; for reviews, see Delfabbro, Thomas, & Armstrong, 2018), boys reported significantly higher levels of gambling severity, alcohol consumption, and craving. In line with prior findings, chasing behavior did not vary by gender (Bibby, 2016; Campbell-Meiklejohn et al., 2008; Lister,

Table 3
Results of the final logistic regression model.

	B	SE	Wald	df	p	Odds ratio (95% CI)
Gender	0.345	0.269	1.643	1	0.200	1.412 (0.833–0.2.391)
GACS ^a Anticipation	2.363	0.376	39.543	1	0.000	10.624 (5.086–22.193)
GACS Desire	1.589	0.645	6.058	1	0.014	4.897 (1.382–17.354)

Note. Dependent variable: Group (nonchasers/chasers); Model: $\chi^2 = 89.86$; Nagelkerke's $R^2 = 0.307$. Overall percentage accuracy rate = 77.5%.

^a Gambling Craving Scale.

Table 4
Summary of hierarchical linear regression analysis with Chasing total score as the dependent variable.

Variable	B	R ²	ΔR^2	β	t	p	VIF
<i>Step 1</i>							
Gender	-1.022	0.010	0.010	-0.100	-1.919	0.056	1.000
<i>Step 2</i>							
Gender	-0.294	0.185	0.175	-0.029	-0.599	0.550	1.029
GACS ^a Desire	8.331			0.425	8.812	0.000	1.029
<i>Step 3</i>							
Gender	0.142	0.232	0.046	0.014	0.292	0.771	1.069
GACS Desire	6.005			0.306	5.738	0.000	1.333
GACS Anticipation	2.971			0.253	4.657	0.000	1.380
<i>Step 4</i>							
Gender	0.354	0.251	0.019	0.035	0.728	0.467	1.091
GACS Desire	5.653			0.288	5.428	0.000	1.350
GACS Anticipation	2.403			0.204	3.651	0.000	1.503
AUDIT ^b	0.158			0.154	3.019	0.003	1.240

Note. B: unstandardized coefficient; ΔR^2 : R square change; β : standardized regression coefficient; VIF: Variance Inflation Factor.

^a Gambling Craving Scale; ^bAlcohol Use Disorders Identification Test.

Nower, & Wohl, 2016; O'Connor & Dickerson, 2003; Worhunsky, Potenza, & Rogers, 2017) or as a function of the experimental condition (Ciccarelli et al., 2019a, 2019b; Lister et al., 2016; Nigro et al., 2018a). Rather, the results of logistic regression analysis suggested that the choice to stop or continue playing depend on both a strong, urgent desire to gamble and the anticipation of immediate positive subjective experiences from gambling, whereas chasing proneness was predicted not only by anticipation and desire to gamble, but also by alcohol consumption.

Table 5
Summary of hierarchical linear regression analysis with SOGS-RA total score as the dependent variable.

Variable	B	R ²	ΔR^2	β	t	p	VIF
<i>Step 1</i>							
Gender	-0.391	0.160	0.160	-0.400	-8.294	0.000	1.000
<i>Step 2</i>							
Gender	-0.316	0.358	0.198	-0.324	-7.562	0.000	1.029
GACS ^a Desire	8.850			0.451	10.545	0.000	1.029
<i>Step 3</i>							
Gender	-0.260			-0.266	-6.514	0.000	1.070
GACS Desire	6.697	0.440	0.083	0.370	8.917	0.000	1.109
AUDIT ^b	0.030			0.307	7.287	0.000	1.139
<i>Step 4</i>							
Gender	-0.249			-0.255	-6.323	0.000	1.076
GACS Desire	6.624	0.457	0.017	0.331	7.790	0.000	1.197
AUDIT	0.026			0.294	7.062	0.000	1.148
CFC-14 Immediate ^c	0.009			0.140	3.374	0.001	1.132
<i>Step 5</i>							
Gender	-0.325			-0.255	-6.323	0.000	1.076
GACS Desire	6.532	0.469	0.012	0.331	7.790	0.000	1.197
AUDIT	0.026			0.294	7.062	0.000	1.148
CFC-14 Immediate	0.008			0.140	3.374	0.001	1.132
GACS Anticipation	0.152			0.134	2.816	0.005	1.536

Note. B: unstandardized coefficient; ΔR^2 : R square change; β : standardized regression coefficient; VIF: Variance Inflation Factor.

^a Gambling Craving Scale; ^bAlcohol Use Disorders Identification Test; ^cConsideration of Future Consequences Scale.

or level of severity within pathological gambling” (p. 43).

Besides, these results are congruent with a previous study on adults indicating that individuals who were more likely to chase and reported more severe chasing persistence showed heightened levels of craving, but not of gambling severity (Ciccarelli et al., 2019b). However, it seems that among adolescents gambling for the pleasure derived from gambling activities and for the expectations of fun contribute to chasing more than gambling involvement.

Furthermore, although some studies indicated that the “Relief” subscale of the GACS predicted persistence in the face of losses (e.g. Ciccarelli et al., 2019b; Young & Wohl, 2009), scores on this dimension did not contribute significantly either to the decision to chase or chasing frequency. It may be that chasing among adolescents arises via the excitement resulting from gambling, rather than via the relief from negative subjective experiences immediately following gambling. However, it may be that among adolescents, unlike gambling severity which was found associated with emotional vulnerability (for a review, see Cosenza, Ciccarelli, & Nigro, 2019a), chasing seems not providing relief from negative affect.

Unexpectedly and unlike Young et al.’s findings (2008), chasing did not vary as a function of experimental condition. It may be that the anticipation of enjoyment from gambling and gambling desire foster the decision to wager further, despite negative outcomes.

All in all, the most interesting result of our study is the marginal role of chasing proneness in gambling severity and of gambling involvement in chasing frequency, at least among adolescents, as well as the central role of craving in both chasing and gambling behavior. Notably, very recent neuropsychological evidence (Piccoli et al., 2020) supports the hypothesis that both craving and chasing stem from functional alterations in cerebellum-related connectivity that might underpin gambling severity (about the role of neurobiological factors in gambling addiction see also Hilbrecht et al., 2020). Although neurobiological differences could be already present or appear as a consequence of harmful gambling (Takeuchi et al., 2017, p. 8), a deeper investigation of their role might shed new light on adolescent gambling, mostly on the association between poor decision-making and gambling severity observed among young people (e. g. Nigro & Cosenza, 2016).

If, regardless of gambling severity, chasers and nonchasers are different subtypes of gamblers clinical interventions should consider the additive role of chasing in gambling disorder. In addition, considering that craving plays a key role in chasing, as well in gambling behavior, therapeutic interventions should also be focused at improving cognitive control and reducing the anticipation of enjoyment from wagering and the urgent desire to gamble. As suggested by Wu et al. (2020), cognitive reappraisal, that is thinking about the negative consequences of addictive behaviors, may be an effective strategy to reduce craving across addictions, including behavioral addictions.

6. Limitations

Although several strengths characterized this study, including the large sample size and the use of a behavioral task to assess chasing, some limitations need to be acknowledged. First, the participants were recruited using convenient sampling of Italian adolescents. Second, the current data are mainly based on self-report measures. In particular, the use of the SOGS-RA to assess gambling severity could be regarded as a limitation of the present study. However, even if some authors questioned the validity of SOGS-RA (see Stinchfield, 2010 for a review), others support the suitability of the instrument as a screening tool in adolescent populations (see Chiesi et al., 2013). Despite these limitations, the present study provides new information regarding the relationship between chasing behavior and craving among adolescents.

7. Conclusions

The present study examined the previously unexplored relationships

of chasing behavior, craving, temporal perspective, alcohol use, and gambling severity among Italian adolescents and demonstrated that the decision to stop or continue playing depends on a strong, urgent desire to gamble as well as on the anticipation of immediate positive subjective experiences from gambling, while chasing proneness depends on both craving and alcohol consumption. Notably, gambling involvement seems to play a marginal role not only in the choice to chase but also in chasing persistence among adolescents. The present findings make an important contribution to the gambling literature, highlighting that two different aspects of chasing may have different underlying mechanisms and that, taken together craving and alcohol misuse might undermine the ability to stop gambling within-session. Considering the possibility that chasers and nonchasers represent two gambling subtypes that differ in terms of motivation, behavior, and severity might contribute to implement psychotherapeutic interventions.

8. Author statement

Authors’ contribution: GN, OM and MCo designed the study and wrote the first draft of the manuscript. MCI conducted literature searches and provided summaries of previous research studies. GN and MCI conducted the statistical analysis. OM revised the manuscript. All authors contributed to and have approved the final version of the manuscript.

Declaration of Competing Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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