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The effects of induced sadness, stress sensitivity, negative urgency, and gender in laboratory gambling

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ABSTRACT

Previous research indicates that the invigorating effect of stress sensitivity on gambling behavior might be moderated by individual differences. The current preregistered study tested whether gender and negative urgency (i.e. an emotion-related impulsivity trait) moderate the relationship between perceived stress and laboratory gambling following experimentally induced sadness. One hundred twenty college students were randomly assigned to a sadness versus a control condition before completing a laboratory gambling task. Although the distribution of the main study variables forced us to slightly deviate from the preregistered data analysis plan, we were able to show that heightened stress sensitivity affects gambling behavior and that this effect differs by gender (but not in terms of negative urgency) under conditions of sadness versus neutral mood. Men with high stress sensitivity gambled more money and more frequently selected the riskier betting option in the sadness condition, whereas women with heightened stress sensitivity display the same pattern in the neutral condition. Our study is relevant from a methodological standpoint and answers recent calls for endorsing open-science practices in gambling research. Findings also suggest that more research into female gambling is warranted and that emotion-regulation skills should be a central component of problem gambling prevention.

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KEYWORDS
Sadness; gender; gambling; emotion induction; stress sensitivity

Problem gambling constitutes a recognized public health issue in adolescents (Molinaro et al., 2018) and adults (Calado & Griffiths, 2016), with college students appearing to be a particularly vulnerable group (Blinn-Pike et al., 2007; Canale et al., 2015; Shaffer & Hall, 2001). At the societal level, the increased availability and legalization of online gambling platforms has been suggested as a risk factor for problem gambling in young people (Blinn-Pike et al., 2007; Nowak & Aloe, 2014). At the psychological level, college student

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Supplemental data for this article can be accessed here.

life is characterized by many challenges (e.g. physiological changes, development of romantic relationships, need to perform at school), the upshot of which is that this period of life is characterized by substantial stress (Lust et al., 2010).

Stress consists of negative emotional and cognitive states in which people recognize that environmental demands strain their resources and threaten their well-being (Lazarus, 1993) and is a significant problem for college students. Previous research has shown that academic and interpersonal stressors are particularly prevalent among undergraduate students (e.g. Hashim & Zhiliang, 2003; Lust et al., 2010). Psychological stress and stressful life events are included in most psychological models of problem gambling as risk factors for the development of gambling-related problems (e.g. Blaszczynski & Nower, 2002; Sharpe, 2002; Valleur et al., 2016). A large corpus of evidence supports that involvement in gambling can reflect a coping strategy for stressful life events or psychological problems (Hum & Carr, 2018; Kim et al., 2019; Schlagintweit et al., 2017). Existing studies suggest that self-reported stress, such as trait stress sensitivity (the extent to which someone tends to perceive stressful situations as uncontrollable, unpredictable, and severe; Cohen et al., 1983) and the occurrence of adverse or stressful life events are associated with gambling participation (Coman et al., 1997; Loo et al., 2008; Raylu & Oei, 2002). Yet, previous research suggests that the relation between stress and gambling involvement is complex and influenced by a wide range of environmental and individual factors. For example, a study conducted with college students did not find a direct association between the occurrence of stressful events during the past year and gambling participation, suggesting that stress may affect gambling behaviors under certain circumstances or in certain vulnerable groups (Lightsey & Hulsey, 2002). Thus, factors other than dispositional or situational stress are likely to influence gambling behavior, implying that individual differences susceptible to moderate the effect of stress sensitivity (e.g. specific personality traits) should be considered in studying gambling behavior. According to systematic reviews conducted by Starcke and Brand (2012, 2016), several candidate moderating variables (e.g. personality traits and physiological variables) have to be considered when studying the effect of stress in situations of decision making under ambiguity, such as gambling (in which the probability of an outcome is largely unknown).

Important gender differences exist regarding candidate personality or physiological variables suggested to moderate decision making in unpredictable situations. Gambling is known to be a gendered activity (Volberg, 2003). Although it has long been considered a mainly male activity, recent evidence suggests that female gambling is on the rise (M. Abbott et al., 2018; Holdsworth et al., 2012) and that gambling participation rates have become relatively similar for men and women (M. Abbott et al., 2018; Faregh & Derevensky, 2013; M. W. Abbott et al., 2014). Yet, men and women seem to differ in their gambling trajectory, with women tending to develop problematic gambling patterns more quickly (see Merkouris et al., 2016, for a review). Therefore, it is important to consider gender as a central variable when investigating problem gambling (Baggio et al., 2018).

Impulsivity might be an important factor to consider for elucidating the impact of stress on the onset of gambling and problematic gambling behavior. Impulsivity, which broadly corresponds to the tendency to act without foresight, is a transdiagnostic factor

involved in the etiology of a wide range of mental and neurological disorders characterized by decision-making impairment, such as gambling (Bechara & Van Der Linden, 2005; Kim et al., 2019). Individual differences in impulsivity are known to play a pivotal role in the onset and maintenance of gambling disorder (e.g. Canale, Rubaltelli, et al., 2017; Jacobs, 1986; Raylu & Oei, 2002), and important gender differences exist regarding impulsivity (women tend to display lower levels of impulsivity than men do; Chapple & Johnson, 2007; Szabó & Jones, 2019). Thus, in the current study, we aimed to address the moderating role of gender and impulsivity traits in the association between stress sensitivity and laboratory gambling.

Stress, gender, and gambling

Gender differences in gambling and problem gambling have been extensively studied (Baggio et al., 2018; Delfabbro et al., 2018; Kandasamy et al., 2014; Venne et al., 2019), with a particular focus on prevalence (gambling disorder is more frequent in men; Fattore et al., 2014; Merkouris et al., 2016) or gambling preferences/formats (favored gambling activities differ according to gender; see e.g. Baggio et al., 2018). The majority of these studies investigated gender differences in gambling behaviors exclusively in at-risk or problem gamblers (e.g. Baggio et al., 2018; Delfabbro et al., 2018; Venne et al., 2019). Yet, uncertainty still abounds regarding the influence of gender on the causal pathway leading to problem gambling. Interestingly, an increased likelihood of problem gambling is associated with women who have higher levels of life stress, whereas stress levels have not been linked to problem gambling in men (Afifi et al., 2010). It is thus plausible that the more elevated level of stress and negative affect experienced by women in our society (Nolen-Hoeksema et al., 1999) is a factor that contributes to the gender differences observed in problem gambling and gambling preferences (McCormack et al., 2014; Tschibelu & Elman, 2010). This view is supported by studies suggesting that stress may elicit divergent effects on gambling behaviors in men and women (see Merkouris et al., 2016, for a review of gender differences in the effect of stress on gambling) and that these differences are also reflected by differential motives for gambling among men and women (e.g. gambling is more frequently used as a coping strategy in women; McCormick et al., 2012). Related to this, women also tend to prefer games that are often used to cope or relieve negative affect or stress, such as slot machines (Baggio et al., 2018; Kairouz et al., 2017; Moragas et al., 2015). Yet, existing studies that addressed the relationships between stress, gender, and gambling are characterized by a major limitation: They largely relied on cross-sectional designs and self-reported measures. Indeed, only a few studies used experimental designs in the laboratory setting. For example, Devos et al. (2018) showed that induced sadness increased persistence in a simulated slot machine task among a sample of community gamblers. Therefore, the field would benefit from a study that reproduced the finding that women gamble more than men in order to cope with psychological distress (e.g. stress sensitivity and negative mood) by using an experimental and controlled design. The current study fills this research gap by testing whether sadness causally increases gambling behaviors in women (especially in women with higher reported levels of stress sensitivity).

Stress, impulsivity, and gambling

It is well established that problem gamblers have higher levels of impulsivity than do matched control participants (Blaszczynski et al., 1997; Canale, Vieno, et al., 2017; Forbush et al., 2008; Slutske et al., 2005) and that impulsivity predicts the severity of problem gambling symptoms (e.g. Lightsey & Hulsey, 2002; Steel & Blaszczynski, 1998). A meta-analysis on impulsivity traits in disordered gambling found that a specific impulsivity facet, that is, negative urgency (the tendency to act rashly when experiencing intense negative emotions), has the greatest effect size among all investigated impulsivity constructs (MacLaren et al., 2011). In a study conducted with 1,120 college students, negative urgency was found to be the impulsivity facet that most strongly predicted at-risk gambling, suggesting that this impulsivity component may constitute an early risk factor in the onset and progression of gambling disorder (Yan et al., 2016). Moreover, emotional arousal and negative affect are known to impede self-control and invigorate impulsive behaviors (e.g. Eben et al., 2020; Pessoa, 2009; Verbruggen & De Houwer, 2007), which likely contribute to the impact of emotional states on excessive or unregulated gambling behaviors. Research is thus needed to elucidate how impulsivity and stress-related variables interact to promote gambling involvement. For example, higher impulsivity was related to more severe problem gambling when adult gamblers experienced high levels of stress in their life, but not when they reported a lower lifetime experience of stressful events (Tang et al., 2011). A study reported that negative urgency is positively associated with greater emotional and behavioral reactivity in response to acutely stressful events (Owens et al., 2018). Negative urgency was also found to be a stable dispositional antecedent that potentiates responses to extreme situational distress (e.g. Engel et al., 2007; S. Fischer et al., 2018) or life stress-associated distress (Ahmed & Koob, 2005). Stressful events frequently imply threats and negative emotions to which people respond differently based on their own psychological and social resources (K. E. Grant et al., 2003). Yet, no experimental studies to date have tested how people with high negative urgency and stress sensitivity make choices in a gambling task following negative mood induction.

The present study

From these theoretical considerations, we aimed to test whether gender and negative urgency moderate the relationship between stress sensitivity and laboratory gambling following experimentally induced sadness. We specifically relied on sadness – as opposed to another specific emotion (e.g. disgust, anger) or general negative mood – because previous research revealed that (a) sadness is characterized by the appraisal theme of experiencing irrevocable loss (Lazarus, 1991) and thus accompanies the action tendency to change one's circumstances, for example, by seeking reward-seeking behaviors (Garg & Lerner, 2013; Lerner et al., 2004; Raghunathan & Pham, 1999); (b) sad individuals are biased in favor of high-risk/high-reward options (Raghunathan & Pham, 1999); (c) stressful events frequently imply threats and negative emotions to which people respond differently depending on their own characteristics (K. E. Grant et al., 2003), such as gender and impulsivity traits; and (d) a previous experimental study found that induced sadness increased persistence in a laboratory gambling task (Devos et al., 2018).

Hypotheses

Hypothesis 1: Participants characterized by elevated stress[1] sensitivity will gamble more than participants with lower perceived stress.

Hypothesis 2: Women will gamble more than men in a sadness condition (whereas men will gamble more than women in a control condition).

Hypothesis 3: Women characterized by elevated stress sensitivity in the sadness condition will gamble more than men with higher perceived stress.

Hypothesis 4: Participants characterized by elevated stress sensitivity and negative urgency in the sadness condition will gamble more than those with high perceived stress and low negative urgency.

Method

Participants and procedure

Participants were 120 college students (age 18–25 years; $M = 22.17$, $SD = 1.76$) recruited through online advertisements on research-related websites and Facebook groups, as well as by snowball techniques. The sample size was determined from past work that used a similar gambling task (FeldmanHall et al., 2015; $n = 60$ participants) and mood induction technique (Devos et al., 2018; $n = 60$ participants). We decided to double the sample size, as we wanted to test gender (two-level variable) as a moderator. Participants were compensated with 5 euros and an additional monetary gain directly related to their result on one randomly selected trial from the gambling task (as in previous studies that used the same gambling task; Canale, Rubaltelli, et al., 2017; FeldmanHall et al., 2015).

The experimental session consisted of two independent phases. In the first phase (1 week before the laboratory experiment), participants were invited to complete an online survey containing self-reported questionnaires that assessed stress sensitivity, trait negative urgency, control variables (attitudes toward gambling, gambling frequency, trait emotional regulation, trait emotional intelligence, depression) and socio-demographic characteristics (sex, age, years of education, employment, and socioeconomic status). All participants were informed about the aims of the study and gave their online informed consent before starting the survey, which took approximately 15 min to complete. Across participants, questionnaires were presented by using a series of semi-random order versions to control for the influence that the order of presentation of different constructs may have on the answers.

In the second phase (approximately 1 week after the administration of the online survey), participants were invited to complete an experiment in the laboratory. They were scheduled for a 30-min experimental session after providing written informed consent. Participants were randomly assigned to a sadness ($n = 60$) versus a neutral ($n = 60$) condition before completing a laboratory gambling task. Mood ratings were measured by using a single-item sadness rating and the negative affect items (e.g.

distressed, upset, or nervous) from the Positive Affect and Negative Affect Schedule (PANAS) state version (Gaudreau et al., 2006; Watson et al., 1988) at three different times (before and after the mood induction; after the gambling task).

Research ethics and preregistration procedure[2]

The study underwent ethical review and received approval from the Ethical Committee for the Psychological Research of the University of Padova (protocol number: 2784). Ethical principles were performed in accordance with the Declaration of Helsinki. All study hypotheses, design, and sample-size data were preregistered and are available on the Open Science Framework (OSF) at https://osf.io/2tu9h/. All data, pretest for the manipulation check, analysis plan, code and task are also available at the OSF.1

Measures (cross-sectional online survey, 1 week before the laboratory experiment)

Key measures

Trait stress sensitivity. Trait perceived stress was assessed by using the Perceived Stress Scale (PSS; Cohen et al., 1983; Italian translation: Fossati, 2010), which contains 10 items that assess the degree to which life events are appraised as stressful. Items are rated on a 5-point Likert scale from 0 (*never*) to 4 (*very frequently*). Higher scores reflect higher levels of perceived stress in response to stressful situations. The PSS exhibited acceptable internal consistency (Cronbach's α = .86; 95% confidence interval [CI] [0.82, 0.90]).

Trait negative urgency. Negative urgency was assessed by using the four-item subscale of the Short UPPS-P Scale (Billieux et al., 2012; Italian version: D'Orta et al., 2015). Response options ranged from 1 (*strongly agree*) to 4 (*strongly disagree*). The scale was scored such that higher scores indicated higher levels of negative urgency. Cronbach's alpha was .85 (95% CI [.80, .89]).

Control variables

Attitudes toward gambling. Attitudes toward gambling were assessed by using the eight-item Attitudes Toward Gambling Scale (ATGS-8; Orford et al., 2009; Canale, Vieno, et al., 2016; Italian translation by the Epidemiology and Health Research Lab, IFC – CNR), which contains eight attitudinal statements that some people have about gambling. ATGS-8 items were scored on a Likert scale from 1 (*strongly disagree*) to 5 (*strongly agree*). The scale was scored such that higher scores indicated more favorable attitudes toward gambling. Cronbach's alpha was .80 (95% CI [.74, .85]).

[1] We thank the OSF team for letting us know about an error we made in the preregistration of the study. Although we created the OSF project 'Clarifying the relationship between perceived stress and laboratory gambling: The moderating role of gender and negative urgency under condition of induced sadness,' which contained all the materials about the present study (rationale, methods, analytical plan, mood-induction pretest, and ethical approval), we failed to finalize the registration of this project because we thought that the creation of the OSF project would automatically imply that it was registered. Because our work was always intended as a registered project and we thought that we had completed the registration, it has not been altered since the following dates: [Date created: 2018–07-03 05:48 PM | Last Updated: 2018–11-09 03:15 PM]. Upon discussion with the OSF team, we decided that, consistent with the values that guide preregistrations and open science practices, it was necessary to be open and transparent about our inadvertent failure to complete the registration process. Laboratory data collection started in 2018–10-16 and finished in 2018–11-8. Analyses were run after data collection was entirely complete.

Trait emotion regulation. Emotion regulation was assessed by using the Emotion Regulation Questionnaire (Italian version: Balzarotti et al., 2010), which contains 10 items on habitual cognitive reappraisal and expressivesuppression in daily life. More specifically, four items form the suppression subscale and six items form the reappraisal subscale. Items are rated on a 7-point Likert scale from 1 (*strongly disagree*) to 7 *(strongly agree*), where higher scores indicate increased use of the regulatory strategy. Cronbach's alphas were .86 (95% CI [.82, .90]) for the reappraisal subscale and .76 (95% CI [.68, .82]) for the suppression subscale.

Trait emotional intelligence. Trait emotional intelligence was assessed by using the Trait Emotional Intelligence Questionnaire-short form (Petrides, 2009; Italian version: Di Fabio, 2013), which contains 30 items asking participants to self-report the tendency to regulate, express, and perceive their emotions. Items are rated on a 7-point scale, ranging from 1 (*completely disagree*) to 7 (*completely agree*). Cronbach's alpha was .88 (95% CI [.85, .91]).

Gambling frequency. Gambling frequency was measured by using seven items that assessed the frequency (number of occasions) with which the students participated in different gambling activities (e.g. sports, betting, and slot machines) in the past year on a 7-point response scale from 1 (*never*) to 7 (*every day*) (Canale, Vieno, Ter Bogt et al., 2016). Frequent gamblers were classified as gamblers who are involved in more than two gambling activities monthly (Kessler et al., 2008).

Depression. Depression was assessed by using the 7-item depression subscale of the short-form Depression Anxiety Stress Scale-21 (Lovibond & Lovibond, 1995; Italian version: Bottesi et al., 2015), based on a 4-point Likert scale (0–3 scale) ranging from 1 (*did not apply to me at all*) to 4 (*applied to me most of the time*). Cronbach's alpha was .86 (95% CI [.82, .90]).

Demographic data form. The demographic data form recorded participants' gender, age, years of education, employment, and socioeconomic status. Socioeconomic status was assessed by using an ad hoc item considering availability of financial resources, based on a 7-point response scale from 1 (*strongly disagree*) to 7 (*strongly agree*).

Measures, mood induction, and task (phase of laboratory test, 1 week after completing the cross-sectional online survey)

State Sadness

A state measure of sadness was assessed by using a 10-point visual analog scale (VAS) with *not sad at all* at one end and *terribly sad* at the other end. Participants were asked to rate their present mood and were instructed to place a mark on the scale to indicate their degree of sadness. The VAS is known to be highly reproducible and sensitive to change (De Boer et al., 2004; S. Grant et al., 1999), and it has been used in previous mood induction studies to assess changes in emotion (Singer & Dobson, 2007; E. Watkins et al., 2003).

State negative affect

Negative affect items (e.g. distressed, upset, or nervous) were from the PANAS state version (Gaudreau et al., 2006; Watson et al., 1988; Italian Version: Terraciano et al., 2003). Items are rated on a 5-point Likert scale from 1 (*very slightly or not at all*) to 5 (*extremely*). Cronbach's alpha was .83 (95% CI [.79, .88]) at Time 1 (before mood induction), .82 (95% CI [.77, .87]) at Time 2 (after mood induction), and .81 (95% CI [.76, .86]) at Time 3 (after the gambling task).

Mood induction

Our study capitalized on the mood induction procedure previously used by Devos et al. (2018). Briefly, all participants were invited to watch movie clips selected from a normative database of emotional clips (Schaefer et al., 2010). Participants randomized to the sadness condition watched a movie clip eliciting sadness (an excerpt from the movie *City of Angels* in which a woman dies in the arms of her husband after a road accident; duration 4 min 16 s). This movie clip was found to induce sadness among recreational gamblers (Devos et al., 2018). Participants in the neutral condition were asked to watch a neutral movie clip (an excerpt from the movie *The Lover* showing a woman getting into a car and the car starting to move. The woman is then dropped off on a busy street, she knocks on a door, and a man opens and lets her in; duration 43 s). Participants were instructed to rest quietly following the neutral movie clip so that the duration of the sadness and neutral conditions would be identical. The pretest for the manipulation check is available at the OSF link (https://osf.io/2tu9h).

Gambling task

The participants' decision to gamble was assessed by using the gambling task used by FeldmanHall and colleagues (2015; for more details, see also Canale, Rubaltelli, et al., 2017). In this laboratory gambling task, participants are asked to choose whether to gamble an amount between 0 euros (€) and 10 € in a series of trials. For each trial, participants are endowed with €10 (placed on the table) and asked to decide whether to gamble between €0 and €10 of their €10 endowment in increments of €2 (i.e. €2 or €4 or €6 or €8 or €10). Thus, they can decide to gamble money (between €2 and €10) or not (€0). Each gamble resulted in either a win or a loss. For example, if participants decided to gamble €4 of the €10, in one scenario, there is the chance to lose their investment of €4 and take home €6. In the other scenario (winning), they would double their money (€8) and take home €14 (€8 + the €6 left of their endowment). Prior to the start of the gambling task, the participants completed four practice trials to become familiarized with the task. The experimental part of the task included 36 trials. After each choice, participants received feedback informing them of the outcome of their decision: negative feedback ('You lost the lottery') or positive feedback ('You won the lottery'). The schematic of one trial is shown in Figure 1. The trials were presented in random order and participants were instructed that all gambles were absolutely independent. A post-task funneled debriefing was used to ask whether the participants believed that the outcomes in the gambling task were manipulated by the research team or not. No participants indicated any suspicions regarding the delivered outcomes (wins or losses).

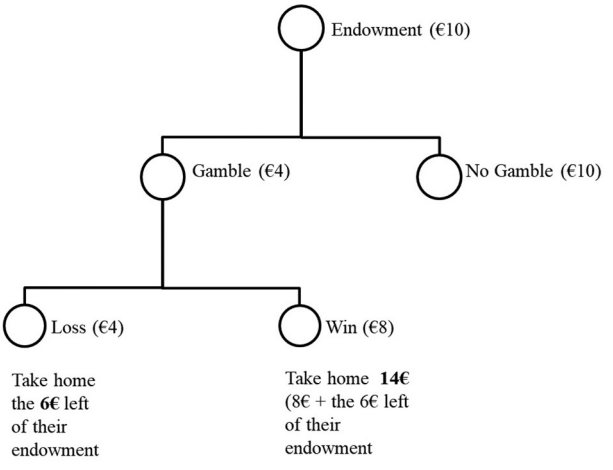

Figure 1. Example of decision to gamble in the gambling task (Canale, Rubaltelli et al., 2017; FeldmanHall et al., 2015).

Participants were also asked to indicate the strategy used to make a decision. None of the participants indicated that a specific strategy made them gamble or caused them to refrain from gambling.

Statistical analyses

Data analysis was conducted according to the preregistered analytic plan (https://osf.io/2tu9h/) and using the open source software R (R Development Core Team, 2013). Parametric (independent sample *t* test) and non-parametric (chi-square) tests were used to compare groups (sadness vs. neutral condition) on the central variables (trait stress sensitivity and trait negative urgency), socio-demographic characteristics (gender, age, years of education, employment, and socioeconomic status), and control variables (attitudes toward gambling, reappraisal and suppression, trait emotional intelligence, gambling frequency, and depression). To determine whether the sadness manipulation was successful in inducing state sadness, we conducted repeated-measure linear mixed-effects models (LMEMs) with Condition (Sadness vs. Neutral) and Time (Pre-induction, Post-induction, and Post-gambling task). To test the primary study hypotheses, we preregistered the following analyses: LMEMs with subjects' money gambled (how much money subjects gambled from €0 to €10) as a continuous variable and generalized mixed-effects models (GMEMs) with the decision to gamble (binary yes/no variable: yes = €2 or €4 or €6 or €8 or €10; no = €0). Yet, after having pre-registered the analytic plan, we realized that using GMEMs (instead of LMEMs) would be more appropriated for the analysis related to the amount bet, given the categorical nature of the response variable and in order to retrieve as much information as possible from the original data (e.g. Agresti, 2003; Davison, 2003). This forced us to adjust our data analytic strategy and thus to deviate from the preregistered analytic plan. Four GMEMs were tested and compared that included the subjects' decision to gamble as a dependent variable (binary variable), subject as a random effect, and the following parameters (fixed effects): trait

stress sensitivity (Model 1); gender, condition, and their interaction (Model 2); trait stress sensitivity, gender, condition, and their interactions (Model 3); and stress sensitivity, negative urgency, condition, and their interactions (Model 4). Note that in all the models, and as preregistered, the response variable was modeled according to a binomial distribution. Although we performed our preregistered analysis plan (see results in online supplement and Table S1), we decided to compute additional analyses because of the multinomial distribution of our outcome variable. This constituted a second deviation from the preregistered analytic plan. Additional non-preregistered generalized linear models (GLMs) were thus run with attractiveness of the gamble being modeled as a multinomial variable with the six categorical levels (€0, €2, €4, €6, €8, €10). Likewise, for the GMEM case, we defined four multinomial GLMs in order to further investigate levels of money gambled (e.g. risky option: betting €10; non-risky option: betting €2). We chose the simpler models with the slope being equal for all odds (the gambling option €0 was used as intercept). The following R packages were used for statistical and graphical analyses: lme4 (Bates et al., 2012), lmerTest packages (Kuznetsova et al., 2017), VGAM (Yee, 2010), brglm2 (Kosmidis & Lunardon, 2020), and ggplot2 (Wickham, 2016).

Results

Preinduction group differences

None of participants' characteristics at baseline were significantly predictive of the sadness condition (Table 1). More specifically, the two groups did not differ significantly in their ratings of negative urgency and stress sensitivity.

Sadness induction experimental check

To determine whether the sadness manipulation was effective, we conducted repeated-measure LMEMs with Condition (Sadness vs. Neutral) and Time (Pre-induction, Post-induction, and Post-gambling task). Analyses confirmed that the mood manipulation was effective, revealing a significant Condition × Time interaction for both sadness ($\chi^2_{(2)} = 49.73$, $p < .001$) and negative affect ($\chi^2_{(2)} = 8.10$, $p = .02$). Although participants in the sadness condition reported an increase in their sadness score and negative affect after sadness induction (Time 2), only the increased sadness ratings after the mood induction were statistically significant between the two conditions. As there was no significant difference between the two groups in terms of negative affect state after the manipulation (Time 2), our experimental manipulation was found to specifically target sadness. Table 2 shows a more detailed description of mood ratings by condition. Mean scores for sadness VAS and negative affect by time are also available at the OSF link (https://osf.io/2tu9h) as supplementary materials (Figure S1 and Figure S2). Finally, gender did not interact with condition and time for both sadness ($\chi^2_{(2)} = 0.19$, $p = .91$) and negative affect ($\chi^2_{(2)} = .51$, $p = .77$).

Table 1. Sample characteristics across conditions [percentage or mean (and standard deviations)].

Characteristics	Condition 1 Sadness (n = 60)	Condition 2 Control (n = 60)	Group difference p value
Socio-demographic characteristics			
Gender (female)	50%	50%	
Age	22.10 (1.80)	22.23 (1.73)	.68
Years of education	15.00 (2.37)	15.43 (1.80)	.26
Socioeconomic status	5.13(1.50)	5.05(1.78)	.78
Employment ('yes')	11.7%	11.7%	
Key measures			
Stress sensitivity	1.81 (0.70)	1.85 (0.63)	.72
Attitudes toward gambling	4.02 (0.53)	3.87 (0.60)	.15
Negative Urgency	2.28 (0.69)	2.30 (0.70)	.90
Control variables			
Reappraisal	4.39 (1.03)	4.74 (1.13)	.08
Suppression	3.56 (1.15)	3.54 (1.32)	.91
Trait Emotional Intelligence	4.65 (0.74)	4.83 (0.68)	.15
Frequent gamblers ('Yes')	5%	5%	
Depression	0.89 (0.70)	0.74 (0.49)	.18

Table 2. Mean sadness/negative affect (and standard deviations) by mood condition and time.

	Sadness VAS			Negative Affect		
	Condition 1 Sadness (n = 60)	Condition 2 Control (n = 60)	Group difference p value	Condition 1 Sadness (n = 60)	Condition 2 Control (n = 60)	Group difference p value
Baseline (Time 1)	3.03 (1.58)	2.77 (1.82)	.39	1.40 (.43)	1.39 (.45)	.90
Post-induction (Time 2)	4.10 (1.90)	2.75 (1.86)	<.001	1.51 (.46)	1.37 (.44)	.10
Post-gambling task (Time 3)	2.98 (1.63)	2.83 (1.90)	.64	1.41 (.39)	1.44 (.43)	.66

Note. VAS = visual analog scale.

Hypotheses testing

As mentioned earlier, beyond our preregistration data analytic plan, we conducted GLMs that modeled the outcome as a multinomial variable with the six categorical levels (€0, €2, €4, €6, €8, €10). Table 3 shows the results of the GLMs. With regard to H1, results revealed a main effect of stress sensitivity ($X^2_{(1)} = 5.67$, $p < .01$). Elevated stress sensitivity weakly increases the probability of choosing higher gambling options ($B = 0.01$, $p < .01$). For H2, there was no evidence of a significant Condition × Gender interaction ($X^2_{(1)} = 0.05$, $p = .81$). With regard to H3, we found a significant interaction of Condition × Gender × Stress sensitivity ($X^2_{(1)} = 39.81$, $p < .001$; $B = -0.11$, $SE = 0.01$, z value = −6.38, $p < .001$). More specifically (see Figure 2), the effect of interaction was more relevant for three levels of the dependent variable (Y0 = €0, Y2 = €2, Y10 = €10). The riskier option (gambled €10, Y10) was selected more frequently (in cases of elevated stress sensitivity) by men in the experimental condition and women in the control condition. The safest decisions (gambled €2) were selected more frequently by men in the control condition (and less frequently by women). Concerning H4, there was no evidence of a significant Stress sensitivity × Negative urgency × Condition interaction ($X^2_{(1)} = 2.13$, $p = .14$; $B = 0.01$, $SE = 0.01$, z value = 1.47, $p = .13$).

Table 3. Results of the GLMs.

Hypotheses	Fixed effects	χ^2	*p* Values	Estimate (*SE*)	*z* Value	*p* Values
H1						
	SS	5.67	.01	0.01 (0.001)	2.42	.01
H2						
	Condition	0.62	.42			
	Sadness vs. Control			−0.03 (0.07)	−0.38	.70
	Gender	0.07	.79			
	Male vs. Female			0.03 (0.07)	0.35	.73
	Condition × Gender	0.05	.81			
	(Sadness vs. Control) × (Male vs. Female)			−0.02 (0.11)	−0.23	.81
H3						
	SS	5.51	.02	0.04 (0.01)	4.47	<.001
	Condition	0.47	.49			
	Sadness vs. Control			−1.42 (0.21)	−6.68	<.001
	Gender	0.06	.82			
	Male vs. Female			−1.18 (0.24)	−4.88	<.001
	SS × Condition	9.56	.002	0.08 (0.01)	6.86	<.001
	SS × Gender	1.03	.30	0.06 (0.01)	5.34	<.001
	Condition × Gender	0.22	.63			
	(Sadness vs. Control) × (Male vs. Female)			1.92 (0.32)	5.89	<.001
	SS × Condition × Gender	39.81	<.001	−0.11 (0.01)	−6.38	<.001
H4						
	SS	4.14	.04	0.11 (0.02)	5.22	<.001
	Condition	0.51	.47			
	Sadness vs. Control			2.17 (0.57)	3.81	<.001
	NU	1.64	.20	0.31 (0.05)	5.97	<.001
	SS × Condition	2.38	.12	−0.05 (0.02)	−1.87	.06
	SS × NU	44.22	<.001	−0.01 (0.01)	−5.46	<.001
	Condition × NU	35.05	<.001	−0.21 (0.06)	−3.23	.001
	SS × Condition × NU	2.13	.14	0.01 (0.03)	1.47	.13

Note. GLM = generalized linear models; SS = stress sensitivity; NU = Negative Urgency.

Discussion

The aim of the current preregistered study was to test whether gender and negative urgency moderate the relationship between stress sensitivity and laboratory gambling under the condition of induced sadness. The preregistered (binomial) models did not support the four hypotheses of the present studies. This might be due to the modeling distribution that was initially selected and preregistered. Taking into account the multinomial distribution of our outcome variable, additional GLMs were run with attractiveness of the gamble being modeled as a multinomial (instead of binomial) variable. Results obtained with these additional and non-preregistered analyses are discussed below. The authors of the present study are mindful of the preliminary nature of these results and the need to replicate them.

Additional non-preregistered analyses showed that there was a positive tendency for participants who had high levels of stress sensitivity to bet money in the gambling task in comparison to participants with low stress sensitivity, although the overall effect was small in our sample. This finding is consistent with existing evidence showing that stress sensitivity is associated with increased gambling behavior (Coman et al., 1997; Loo et al., 2008; Raylu & Oei, 2002). Although much caution is warranted when interpreting this small effect, the current findings are consistent with the view that gambling might constitute a coping strategy when someone is confronted with challenging and/or

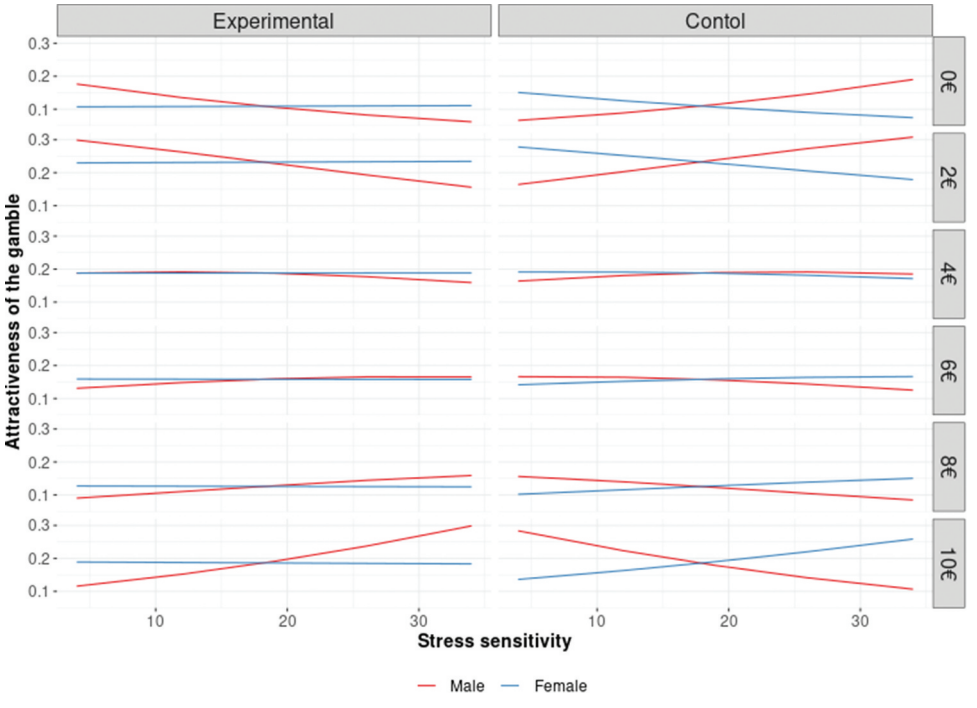

Figure 2. Interaction plot for stress sensitivity, gender, and condition in relation to attractiveness of the gamble (i.e. how much money subjects gambled from €0 [Y0] to €10 [Y10]).

stressful situations (Bergevin et al., 2006; Gupta & Derevensky, 2000). More broadly, our findings are also congruent with the view that elevated stress sensitivity can invigorate motivation for behaviors promoting pleasure (Brand et al., 2016). Another possible explanation is that stress sensitivity fosters erroneous gambling cognitions (Friedland et al., 1992; Preston et al., 2007). Indeed, experimental studies have found that stressed participants were more likely to display distorted gambling cognitions such as the illusion of control (Friedland et al., 1992) and that they favor short-term-based choices, even when they are objectively less rewarding (Gray, 1999).

Contrary to our preregistered hypotheses, the present study did not show that induced sadness promotes gambling behaviors in female college students. This finding runs counter to our prediction that betting choices would increase in women and decrease in men after sadness induction. It is known that state sadness exacerbates mind wandering in experimental contexts and reduces the amount of attentional commitment to the task by increasing the participant's focus on task-irrelevant personal concerns (Smallwood et al., 2009); it is also known that women are generally more prone to ruminative thinking when they experience negative affect (Nolen-Hoeksema, 2001) and are generally more likely (in comparison to men) to report mind wandering about the future (Mar et al., 2012). As previous studies found that those who ruminated on sadness made less risky decisions (Szasz et al., 2016) and that mind wandering is associated with a tendency toward less extreme delay discounting (Smallwood et al., 2013), it is possible that female participants in the sadness conditions were less attracted to gambling.

Contrary to our Hypothesis 2, we also found that men did not bet more money than women in the neutral condition, implying that both genders refrain from gambling when they are not faced with emotional contexts.

With regard to H3, the additional non-preregistered analyses showed that stress sensitivity affected gambling behavior in opposite ways for men and women in our two experimental conditions. More specifically, we found that men with high stress sensitivity gambled more money and more frequently selected the riskier betting option (gambled €10) in the sadness condition, whereas women with heightened trait stress sensitivity shown this same risky pattern of gambling behaviors in the control (neutral mood) condition. Although not aligned with our hypothesis, these results might be related to previous findings that stress leads to more risk taking under uncertainty in men, but decreased risk taking in women (Preston et al., 2007; Van den Bos et al., 2009). Along the same lines, it has been shown that the stress provoked by exposure to aversive movie clips reduced risky decision making in women (Bogdan & Pizzagalli, 2006; Ossewaarde et al., 2011). Another plausible explanation is that stress-prone men in the sadness conditions might have experienced a threat to masculinity (as sadness is an emotion typically associated with the female gender; e.g. Brody & Hall, 2010; A. H. Fischer et al., 2004; Weber & Wiedig-Allison, 2007), for which establishing masculinity might be a potential motivation to engage in gambling for male participants (Hunt & Gonsalkorale, 2018). The finding that women who reported higher stress sensitivity engaged in more risky betting in the neutral condition is consistent with previous studies suggesting that women may gamble to cope with psychological distress and/or are more susceptible to psychological distress than men are (Desai & Potenza, 2008; Petry & Steinberg, 2005; Van Der Maas, 2016).

Contrary to H4, the present study did not show a significant interaction effect of negative urgency and stress sensitivity on gambling in a situation of induced sadness. This null effect, although counter to our expectations, is consistent with a recent study showing that negative urgency does not interact with stressful life events and gambling to cope in predicting problems in participants (Wang et al., 2020). We cannot exclude the possibility that the null effect of negative urgency in the present study may be due to the individual characteristics of the participants (nonclinical participants). Indeed, a meta-analysis by Johnson et al. (2016), for example, showed that the link between negative urgency and inhibitory control was robust in a clinical sample (weighted mean $r = .34$) but very small in nonclinical samples (weighted mean $r = .12$). It is thus likely that a potential effect of negative urgency would appear only in clinical samples or in samples of individuals with marked psychopathological symptoms. In addition, it is possible that state sadness does not exacerbate negative urgency, as most urgency items of the s-UPPS-P assess impulsive behaviors in response to being angry or upset (and none of the four items used specifically targeted sadness). Further research should adapt the urgency item to also target sadness. Finally, we cannot exclude the possibility that our study was insufficiently powered to detect the expected interaction effect.

Some limitations of the study must be acknowledged. First, we used a convenience sample of Italian college students, and our sample comprised a low proportion of frequent gamblers (5%), which limits the generalizability of our findings to other groups (e.g. older people; not Italian college students), clinical samples, or at-risk or problem gamblers. In addition, sample size was based on samples used by two prior studies (Devos

et al., 2018; FeldmanHall et al., 2015) and not a priori power analysis. Second, the manipulation check relied on a single-item sadness rating and did not generalize to the broader negative affect items on the PANAS. We did not collect data on specific cognitive mechanisms related to negative mood – such as rumination and mind wandering – which could have helped explain the differential causal role of sadness in gambling behaviors by gender. Although we used a global factor of perceived stress, controversy exists regarding the Perceived Stress Scale and whether it is a unidimensional or a two-dimensional measure (Nielsen et al., 2016). Third, it may have been useful to assess disordered gambling symptoms in order to check whether problematic gambling modulates performances on the gambling task or affects the detection of problematic gamblers in the experiment (and their potential exclusion). However, the proportion of frequent gamblers (i.e. participants involved in more than two gambling activities monthly) in our sample was extremely low, implying that it is unlikely that problem gamblers were included. Finally, our study results indicated that stress sensitivity interacts with sadness induction to predict gambling behaviors, yet other unconsidered cognitive mechanisms that have been linked to decisions and stress responses (e.g. gambling-related cognitive distortions; Tang & Oei, 2011) should also be considered as potential moderators in future research.

Despite these limitations, the present study is likely the first to clarify gender differences in using gambling as a means to escape personal distress in a laboratory context and in a community sample. Our findings suggest that male participants with higher stress sensitivity gambled more (betting on riskier options) under a sadness condition, whereas female participants tended to gamble to escape under a neutral mood condition. This study is particularly relevant from a methodological perspective. Following two recent calls for open science practices and well-conducted replications in the field of gambling studies (LaPlante, 2019; Wohl et al., 2019), we preregistered our hypotheses, our sampling plan, and our analysis plan to prevent the inflation of a false positive rate and to enhance transparency and accountability (Munafò et al., 2017; Nosek & Lakens, 2014; Simmons et al., 2011). Our results, although preliminary and in need of replication, may also have implications for prevention and policy. First, considering the well-recognized male bias in gambling research and policy (McCarthy et al., 2019), the present study also helps to overcome the gender-blind research approach by providing an adequate understanding of female gambling, which could be important for the development of gender-sensitive prevention strategies. In light of the rising rates of gambling-related harm among women, further research should be conducted to increase scientific knowledge about women's gambling. Second, prevention and education strategies should focus on developing adaptive coping strategies for stress, such as distracting oneself from a stressor by thinking about or engaging in activities that induce positive emotion (Waugh et al., 2020). Advertising that normalizes gambling under stressful circumstances should be discouraged. Although our results were obtained in non-clinical participants, they potentially support the implementation of psychological interventions focused on adaptive cognitive emotion regulation skills (L. E. Watkins et al., 2015) or mindfulness-based techniques adapted to gambling (Griffiths et al., 2016). Finally, strategies that help increase social support from family members, friends, and current romantic partners and that enhance resilience should be included in prevention intervention programs on

college campuses to decrease students' psychological distress (Gheshlagh et al., 2017; Thorsteinsson et al., 2013) and potential involvement in potentially maladaptive coping strategies, such as gambling.

Note

1. The original preregistration used the term 'perceived stress' instead of 'stress sensitivity.' We changed the term because the latter better accounts for individual differences in response to daily life stressors.

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No potential conflict of interest was reported by the author(s).

Data Availability Statement

The data described in this article are openly available in the Open Science Framework at https://osf.io/2tu9h/.

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