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ORIGINAL ARTICLE

Exploring the association between psychological distress and drunkorexia behaviors in non-clinical adolescents: the moderating role of emotional dysregulation

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Abstract

Purpose Although drunkorexia seems to represent a new form of eating disorder, it shares several features with traditional eating disorders. However, very little is known about the association between drunkorexia and a widely studied correlate of eating disorders, such as psychological distress and about mechanisms underlying this association. The present study aimed to investigate the relation between symptoms of anxiety and depression and drunkorexia, and to explore the role of emotional dysregulation as moderator of this relationship.

Methods The sample was composed of 402 adolescents (222 females, 180 males; range 15–21) who completed self-reported measures: Drunkorexia Motives and Behaviors Scale, which assesses different behaviors and motivations associated with drunkorexia, Emotional dysregulation scale from the Eating Disorder Inventory-3, reflecting difficulties regulating emotions, and Anxiety and Depression scales from the Symptom CheckList-90 Revised, assessing general signs of anxious and depressive symptoms.

Results Anxious symptomatology resulted a significant statistical predictor of drunkorexia behaviors ($\beta = .28$, $p = .001$). Furthermore, emotional dysregulation moderated the relation between anxiety and drunkorexia; specifically, a positive relation was found both at medium levels ($\beta = .22$, $p = .007$) and at higher levels of emotional dysregulation ($\beta = .38$, $p = .000$), whereas at lower levels of emotional dysregulation, this association became nonsignificant.

Conclusions Findings suggest that adolescents who experience both elevated anxiety and emotional dysregulation may be more likely to turn to drunkorexia to reduce their unregulated negative affect in the absence of more adaptive emotion regulation strategies. Implications for intervention and prevention programs are discussed.

Level of evidence Level V, descriptive study.

Keywords Drunkorexia · Anxiety · Emotional dysregulation · Psychological distress · Adolescence

Introduction

Drunkorexia has been proposed as a new form of eating disorder characterized by indulging in a variety of unhealthy weight control behaviors on days of planned alcohol consumption [1, 2]. No consensus has yet been reached on systematic criteria and a formal acceptance, and recognition from the medical community is still missing [1, 3]. However, drunkorexia generally includes maladaptive behaviors, such as a self-imposed calorie restriction [4], fasting [5], excessive exercising [6], purging [7], and use of laxatives [8] which occur in relation to alcohol consumption [2, 12], to compensate for the calories ingested through alcoholic beverages [9, 10] or to increase the intoxicating effects of alcohol [4, 11]. Compensating for calories consumed though alcoholic beverages to prevent weight gain represents a primary motivation underlying drunkorexia [8, 10]. For the fear of putting on weight, young people who engage in this behavior, tend to force themselves to follow strict rules to

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control both the amount and the type of food or alcoholic drinks to consume [12].

Although growing evidence suggests that drunkorexia may be distinct from other eating disorders, several overlapping features have been found, such as the fear of weight gain, fasting, and indulging in compensatory behaviors [5, 8, 10]. Furthermore, different important risk factors for the traditional forms of eating disorders resulted also related to drunkorexia: drive for thinness, body dissatisfaction, a poor body esteem, ascetic tendencies, and difficulties regulating emotions [5, 13–15]. However, in the context of drunkorexia, little consideration has been given to the potential role of psychological distress, especially of anxiety and depression that represent extensively studied correlates of existing eating disorders [16–22]. Numerous theorists have postulated that symptoms of anxiety and depression might be risk factors for eating disorders [16, 20, 22]. For instance, the affect regulation model have suggested that individuals who experience depressive symptoms may indulge in disordered eating behaviors (e.g., binges) to reduce depression by means of distraction and comfort from aversive emotional states, associated, for instance, to self-criticism of weight and shape, as well as their over-evaluation [22–25]. Indeed, individuals who engage in disordered eating may have unrealistic high standards and internalized expectations related to the achievement of a thin body [20]; however, when they feel to fail in reaching such ideals, disordered eating may reduce or distract individuals from the negative emotional states they are unable to bear and modulate [20, 26]. Also anxious symptoms have been linked to disordered eating behaviors [16–21]. It has been suggested that disordered eating may serve as safety behaviors, which individuals with anxiety use to prevent a feared situation or as a way of gaining control [20]. Specifically, restrictive eating and compensatory behaviors may be used as safety behaviors in attempt to decrease anxiety associated with the fear of gaining weight perceived as dangerous and uncontrollable and thus, as a way to gain a sense of control believed as inadequate to face such event [20, 27, 28]. Thus, strictly monitoring body weight and overeating may function as a means of reducing anxiety by achieving a sense of personal control over a threatened situation, such as an increase in weight [20, 28]. To our knowledge, only one study has explored the association between drunkorexia and anxious and depressive symptoms in a sample of college-aged women [11]. Roosen and Mills [11] highlighted that women who reported intentional restrictive eating prior to consuming alcoholic beverages showed more symptoms of anxiety and depression compared to women who reported eating more prior drinking to avoid the negative consequences related to alcohol, such as getting sick or having a hangover.

Despite the frequent association found between symptoms of anxiety and depression and eating disorders, mechanisms underlying such relation are unclear. As not all individuals with high anxiety or depression exhibit eating disorders, other factors may influence this association, enhancing the risk of indulging in disordered eating. Emotional dysregulation represents one of the main factors repeatedly associated with disordered eating [29–31] and may be a potential factor to examine in this relation. Research suggests that the use of ineffective emotion regulation strategies, which prolong and amplify negative affect, represents a significant risk factor for the development and maintenance of eating disorders in adolescents [29, 30]. Specifically, eating disorder vulnerability has been associated to a more frequent use of emotion suppression and avoidance and less frequent use of emotion reappraisal, leading to the maintenance of aversive states experienced (e.g., anxiety and depression), and thus, increasing the likelihood of indulging in dysfunctional eating behaviors to reduce the negative affect [29, 32, 33]. It has been suggested that individuals with anorexia nervosa who experience feelings of shame or anxiety in response to events related to food and body shape, and have difficulties in managing and expressing such feelings, are more likely to engage in restrictive eating to reduce the experience of anxiety or shame [34]. Indeed, individuals with eating disorders may have inadequate emotion expression, especially difficulties in expressing and controlling anger [35, 36]. Thus, disordered eating behaviors, including bingeing and compensatory behaviors, may be used as a way to cope with anger and frustration in absence of more adaptive ways of emotion expression [36]. Also adolescents who engage in drunkorexia have shown difficulties in regulating emotions and may use such dysfunctional behavior as a means to cope with emotional affect they have difficulties to manage with and may use drunkorexia as a coping strategy [5, 15]. Thus, in light of existing literature, it is plausible that individuals who experience symptoms of anxiety or depression and have also elevated difficulties in regulating such distress, might be more likely to indulge in eating disordered behaviors to distract from or reduce their unregulated distress, in absence of more adaptive ways of coping with such negative emotional experiences.

The aim of the present study was twofold. The first aim was to explore the relationship between psychological distress (anxious and depressive symptoms) and drunkorexia in adolescents. The second aim was to investigate the interaction effects between psychological distress and emotional dysregulation on drunkorexia. To the best of our knowledge, this was the first study to examine the link between psychological distress and drunkorexia behaviors in adolescents and what is more, to consider emotional dysregulation as a potential moderator of this relationship. Specifically, in line with a past research [11], we hypothesized that both depressive and anxious symptomatology would be significantly related to drunkorexia behaviors.

Furthermore, in line with prior research [29, 32–34], we hypothesized that emotional dysregulation would moderate the relation between psychological distress and drunkorexia.

Methods

Participants and procedure

For the present study, 428 adolescents were recruited in the 11th, 12th, and 13th grade of public high schools. As an inclusion criterion for participation, students were asked if they had ever drunk alcohol in the past 12 months. Only adolescents who answered affirmatively and completed the self-administered measures were selected for the study. Thus, the final sample was composed of 402 adolescents (222 females, 180 males). The average age of the students was 18.10 years (SD = .88; range 15–21). Recruitment of participants began by contacting schools and sending a letter to principals describing the objectives and procedures of the study. Schools' selection was based on their willingness to participate in the present research. Five of the schools contacted agreed to take part in the study, while two schools declined to participate. After obtaining approval from schools' principals to take part in the current study, students were invited to participate and were given information about the general purpose of the study to investigate the emerging phenomenon "drunkorexia" and potential factors that may be involved in the engagement of this behavior. In addition, they were given informed-consent forms, accompanied by an information letter for students' parents to explain the general aim of the study. The participation of the adolescents was preceded by the attainment of both students and their parents' informed consent. Participants did not receive any reward to take part in the study. The voluntary nature of participation was ensured as well as the anonymity of results. The self-reported questionnaires were administered during lesson times and took approximately 30 min to complete. This survey was reviewed and approved by the Ethics Committee of the Department of Developmental and Social Psychology of Sapienza, University of Rome.

Measures

Demographic Questionnaire

Participants were asked to provide information regarding several variables including gender, age, height, and weight. Self-reported weight and height were used to calculate body mass index (BMI).

Drunkorexia Motives and Behaviors Scale (DMBS)

Drunkorexia Motives and Behaviors Scale (DMBS; [37] is composed of 23 items and includes two subscales: Drunkorexia Motives (11 items) and Drunkorexia Behaviors (12 items). Drunkorexia Motives subscale assesses the reasons why individuals engage in drunkorexia (sample item, "On a day I planned to drink, I controlled my eating to fit in with a group I like") and Drunkorexia Behaviors reflects the different behaviors associated with drunkorexia (sample item, "On a day I planned to drink, I controlled my eating by avoiding fatty foods"). Responses are on a 5-point Likert scale ranging from never (1), almost never (2), sometimes (3), almost always (4), and always (5). Psychometric analyses have demonstrated that Drunkorexia Motives and Behaviors Scale is a reliable and valid measure, showing an excellent internal consistency (Cronbach's alpha was .97 for Drunkorexia Motives and .98 for Drunkorexia Behaviors) and a good discriminant and face validity [37]. Previous studies have revealed a good reliability of DMBS also in the Italian context [5]. For the purpose of the study, only Drunkorexia Behaviors subscale was used. To discriminate adolescents who restricted their calories or food intake on days when drinking alcohol was planned (restrictors), and adolescents who reported never engaging in drunkorexic behaviors (non-restrictors), we considered as indicating no drunkorexic tendencies, only non-reported restrictive eating in response to alcohol use (answer option 1 "Never"; Drunkorexia behaviors score = 12), in line with previous studies [37].

Eating Disorders Inventory-3 (EDI-3)

The Emotional Dysregulation Scale from The Eating Disorder Inventory-3 (EDI-3; [38]) was administered for the study. The EDI-3 is a widely used self-report measure that assesses psychological features and symptoms relevant to eating disorders. The instrument consists of 91 items organized into 12 primary scales: 3 eating disorder-specific scales (Drive for Thinness—DT; Bulimia—B; Body Dissatisfaction—BD) and 9 general psychological scales (Low Self-Esteem—LSE; Personal Alienation—PA; Interpersonal Insecurity-II; Interpersonal Alienation—IA; Interoceptive Deficits—ID; Emotional Dysregulation—ED; Perfectionism—P; Asceticism—A; Maturity Fears—MF). The Emotional Dysregulation scale refers to internal states, reflecting mood instability, impulsivity, and self-destructiveness [38]. Participants respond to items on a 6-point Likert scale, ranging from 0 = "always" to 5 = "never". Individual item scores are summed to yield a total score; higher scores signify greater Emotional dysregulation. The EDI-3 has demonstrated to be a reliable and valid tool for both clinical and nonclinical populations [38, 39]. The Italian version of EDI-3 [40] has shown good psychometric properties. Internal reliability of

the scales range from .80 to .90, and test–retest reliability coefficients for the composite scales are between .93 and .98.

Symptom CheckList-90-Revised (SCL-90-R)

The Symptom CheckList-90-Revised (SCL-90-R; [41]) is a 90-item self-report symptom inventory designed to assess psychological distress in both clinical and research settings. The SCL-90-R consists of nine subscales that reflect nine primary symptom dimensions: Somatization (SOM), Obsessive–compulsive (O-C), Interpersonal sensitivity (I-S), Depression (DEP), Anxiety (ANX), Hostility (HOS), Phobic anxiety (PHOB), Paranoid ideation (PAR), and Psychoticism (PS). In this study, Depression and Anxiety subscales were used. Depression subscale reflects a representative range of depressive symptoms such as withdrawal of life interest, lack of motivation, feelings of hopelessness, and other cognitive and somatic correlates of depression. Anxiety subscale reflects general signs of anxiety such as nervousness, tension and trembling, feelings of apprehension, dread, and terror. Each item is rated on a 5-point scale of distress from 0 (not at all) to 4 (very much). The SCL-90-R has shown to be a valid and reliable measure of psychological distress in adolescents in both International [42] and Italian studies [43].

Statistical analysis

All data were analyzed using SPSS Statistics Version 25.0. Preliminary, we investigated gender differences by conducting one-way ANOVAs on drunkorexia behaviors and emotional dysregulation. We carried out MANOVA on SCL-90-R Depression and Anxiety subscales. A Chi square test was performed to investigate gender differences between restrictors and non-restrictors. Furthermore, to examine differences between the two groups on study variables, one-way ANOVAs were carried out on emotional dysregulation and BMI self-reported and MANOVA was conducted on depression and anxiety. For these multivariate analyses, Wilks' λ criterion was used. Partial eta-squared values were calculated as a measure of effect size, and results were interpreted using Cohen's [44] guidelines for determining small (0.01), medium (0.06), and large (0.14) effects.

Pearson correlations were performed to examine the relationship among the key variables: drunkorexia behaviors, emotional dysregulation, depression, anxiety, and BMI. For Pearson correlations, Cohen's [44] guidelines were used for interpreting magnitude of correlation coefficient "*r*": small (0.10), medium (0.30), and large (0.50) effect.

We performed preliminary analyses to verify assumptions of hierarchical regression and exclude the possibility of collinearity. A moderated multiple regression analysis was conducted to investigate the interaction effects between psychological distress and emotional dysregulation on drunkorexia behaviors, as well as to examine the unique contribution of the independent variables on drunkorexia, controlling for the effect of gender, age, and BMI.

The regression analysis was conducted in four steps with drunkorexia behaviors as dependent variable. Gender (females = 0, males = 1), age and BMI were entered in step 1 as covariates to control for their potential confounding influence, as previous studies showed a relationship between drunkorexia and these variables [10, 45]. In step 2, emotional dysregulation was entered to test its main effect controlling for gender, age, and BMI. The SCL-90-R Depression and Anxiety subscales were entered in step 3 to measure their statistical predictive power in drunkorexia behaviors, controlling for the independent effects of the covariates and emotional dysregulation. Finally, to test the interaction effects of psychological distress and emotional dysregulation on drunkorexia, the interaction terms (the cross product of the centered SCL-90-R subscales and Drunkorexia behaviors) were added in step 4. Following the recommendation by Cohen, Cohen, West, and Aiken [46], the independent variables (age, BMI, emotional dysregulation, anxiety, and depression) were mean-centered in the regression equation (except gender which was dummy coded, see Table 2). We used simple slope analysis to explore the significant interaction effects [47]. This analysis was performed by plotting the predicted values of drunkorexia behaviors as a function of anxiety at three levels of the moderator: the mean (medium), 1 SD below the mean (low) and 1 SD above the mean (high).

Results

Preliminary analyses

Gender differences

Descriptive statistics for the key variables used in the present study are shown in Table 1.

One-way ANOVA did not show any significant difference between males and females neither on Drunkorexia behaviors, $F\ (1, 400) = 1.37$, $p = .24$, nor on emotional dysregulation, $F\ (1, 400) = 2.83$, $p = .09$. Conversely, MANOVA on SCL-90-R subscales revealed a significant main effect for gender, $\lambda = .95$, $F\ (2, 399) = 10.73$, $p = .000$, $\eta_p^2 = .05$. Results of the univariate tests showed that males and females differed on both Depression, $F\ (1, 400) = 17.57$, $p = .000$, $\eta_p^2 = .04$, and Anxiety subscales, $F\ (1, 400) = 20.35$, $p = .000$, $\eta_p^2 = .05$, where females showed a higher mean score than males.

Table 1 Descriptive statistics, Cronbach's alpha, and correlations among study variables

Variable	Range	Females ($N=222$)		Males ($N=180$)		Total sample ($N=402$)		1	2	3	4	5
		M	SD	*M*	SD	*M*	SD					
1. Drunkorexia behaviors (DMBS)	12–60	16.11	8.08	15.27	5.98	15.72	7.21	–				
2. Emotional dysregulation (EDI-3)	0–32	7.36	6.28	6.34	5.74	6.91	6.05	.30*	–			
3. Depression (SCL-90-R)	0–1.21	0.64	0.24	0.53	0.26	0.59	0.25	.27*	.54*	–		
4. Anxiety (SCL-90-R)	0–1.23	0.53	0.26	0.41	0.25	0.47	0.26	.33*	.60*	.79*	–	
5. BMI self-reported	14.68–38.16	21.45	3.17	23.27	3.59	22.27	3.48	.05	.01	.01	.01	–
Cronbach's alpha		–	–	–	–	–	–	.93	.76	.89	.85	–

*$p < .001$

Differences between restrictors and non-restrictors on emotional dysregulation, anxiety, depression, and BMI

The sample was composed of 231 (57.5%) non-restrictors and 171 (42.5%) adolescents who reported restricting their calories or food intake on a day they planned to drink alcohol. Of those, 76 (44%) were males and 95 (56%) were females. The Chi square test revealed no significant gender difference between restrictors and non-restrictors, $\chi^2 = (1) = .01$, $p = .91$.

Results from one-way ANOVA on emotional dysregulation showed a significant difference between restrictors and non-restrictors, F (1, 400) = 15.28, $p = .000$, where restrictors reported a higher mean score than non-restrictors. Conversely, one-way ANOVA on BMI did not show any significant difference between the two groups, F (1, 400) = 1.67, $p = .20$. Finally, MANOVA on SCL-90-R subscales revealed a main effect of groups $\lambda = .94$, F (2, 399) = 12.95, $p = .000$, $\eta_p^2 = .06$. Specifically, univariate tests showed that restrictors and non-restrictors differed both on Depression, F (1, 400) = 18.48, $p = .000$, $\eta_p^2 = .04$ and on Anxiety subscales, F (1, 400) = 25.63, $p = .000$, $\eta_p^2 = .06$, where restrictors reported higher mean scores compared to adolescents who did not engage in drunkorexia behaviors.

Correlations among study variables

Pearson correlations were performed to examine the relationship among the key variables used in the present study: drunkorexia behaviors, emotional dysregulation, depression, anxiety, and BMI self-reported (Table 1). Drunkorexia behaviors was significantly and positively associated to emotional dysregulation ($r = .30$, $p = .000$), depression ($r = .27$, $p = .000$), and anxiety ($r = .33$, $p = .000$). No correlation was found between drunkorexia behaviors and BMI ($r = .05$, $p = .34$).

Moderating role of emotional dysregulation

All the variance inflation factor (VIF) values fell below the recommended cut-off of 5 [48], suggesting multicollinearity is not a serious issue in our data. The results of the hierarchical multiple regression are presented in Table 2. Gender, age, and BMI entered in step 1 as control variables were not related to drunkorexia behaviors, conversely, emotional dysregulation entered in step 2 emerged as a significant statistical predictor of drunkorexia behaviors, $\beta = .32$, $p = .000$ accounting for 10% of the variance. In step 3 SCL-90-R Depression and Anxiety subscales were added to the model; only anxiety was found to statistically predict drunkorexia behaviors, $\beta = .28$, $p = .001$, while depression was not found to be significantly related to drunkorexia behaviors. The results of step 4 revealed a significant interaction between anxiety and emotion dysregulation in statistically predicting drunkorexia behaviors adding a significant 6% to the explained variance. Overall, the final model accounted for 19% of the variance.

Results from simple slopes analysis are displayed in Fig. 1. There was a significant and positive relation between anxiety and drunkorexia behaviors at medium levels ($\beta = .22$, $p = .007$) and at higher levels of emotional dysregulation ($\beta = .38$, $p = .000$). However, at lower levels of emotional dysregulation, this association became not significant ($\beta = .06$, $p = .88$). Findings suggest that experiencing higher anxious symptoms is related to an increase in drunkorexia behaviors, especially in adolescents who reported high levels of emotional dysregulation. Conversely, for adolescents with low levels of emotional dysregulation, anxiety had no significant effect on drunkorexia behaviors.

Discussion

The aim of the present study was twofold. Firstly, we investigated the relation between psychological distress (anxious and depressive symptoms) and drunkorexia behaviors in a

Table 2 Regression analysis testing the moderating role of emotional dysregulation in the relationship between SCL-90-R subscales and drunkorexia behaviors

Predictor	Drunkorexia behaviors								
	B	SE B	*β*	*p* value	95% CI	Adj. R^2	R^2	ΔR^2	ΔF
Step 1						.005	.01	.01	F (3, 380) = 1.67, p = .17
Gender	− 1.18	0.77	− 0.08	.13	− 2.69 to 0.34				
Age	− 0.46	0.41	− 0.06	.26	− 1.27 to 0.35				
BMI self-reported	0.14	0.10	0.08	.15	− 0.05 to 0.33				
Step 2						.10	.11	.10	F (1, 379) = 42.24, p = .000
Gender	− 0.72	0.73	− 0.05	.32	− 2.17 to 0.72				
Age	− 0.16	0.39	− 0.02	.68	− 0.94 to 0.61				
BMI self-reported	0.13	0.09	0.07	.15	− 0.05 to 0.32				
Emotional dysregulation	0.38	0.06	0.32	.000	0.27 to 0.50				
Step 3						.14	.15	.04	F (2, 377) = 9.56, p = .000
Gender	− 0.10	0.73	− 0.01	.90	− 1.54 to 1.35				
Age	− 0.08	0.39	− 0.01	.84	− 0.84 to 0.68				
BMI self-reported	0.13	0.09	0.07	.16	− 0.05 to 0.31				
Emotional dysregulation	0.20	0.07	0.17	.005	0.06 to 0.34				
Depression	− 0.56	2.22	− 0.02	.80	− 4.93 to 3.81				
Anxiety	7.70	2.29	0.28	.001	3.20 to 12.19				
Step 4						.19	.21	.06	F(2, 375) = 13.33, p = .000
Gender	0.02	0.71	0.00	.98	− 1.39 to 1.42				
Age	− 0.17	0.37	− 0.02	.66	− 0.90 to 0.57				
BMI self-reported	0.13	0.09	0.07	.15	− 0.04 to 0.30				
Emotional dysregulation	0.07	0.08	0.06	.37	− 0.08 to 0.21				
Depression	0.36	2.16	0.01	.87	− 3.89 to 4.61				
Anxiety	6.11	2.24	0.22	.007	1.70 to 10.52				
Depression × emotional dysregulation	0.25	0.39	0.07	.51	− 0.51 to 1.01				
Anxiety × emotional dysregulation	0.73	0.35	0.21	.04	0.04 to 1.41				

Gender was coded as 0 (females) and 1 (males)

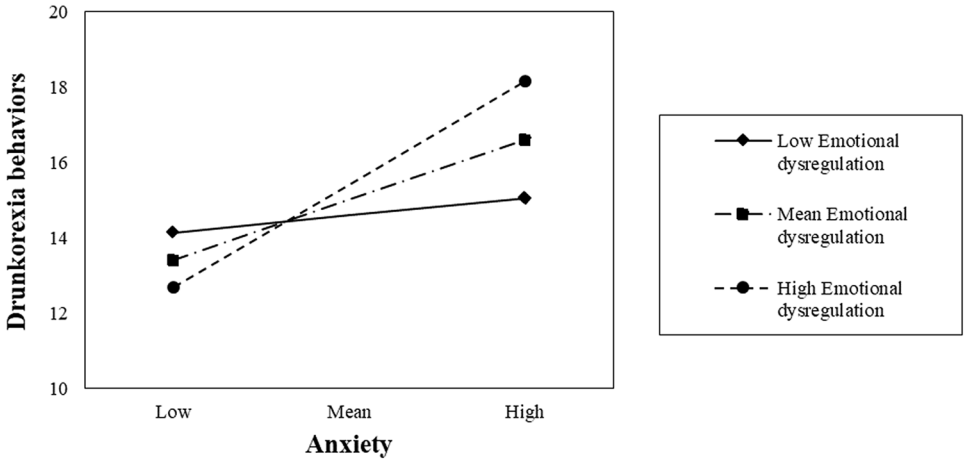

Fig. 1 Simple slope analysis of the moderating role of emotional dysregulation in the link between anxiety and drunkorexia behaviors

sample of adolescents. Second, we explored the role of emotional dysregulation as moderator of this relationship.

In line with Roosen and Mills [11], our findings revealed the both depressive and anxious symptoms were correlated to drunkorexia behaviors, underlying that also in adolescents, intentional restrictive eating in response to alcohol use was significantly related to psychological distress such as anxiety and depression. However, only anxious symptomatology resulted as a significant statistical predictor of drunkorexia among adolescents, suggesting that, conversely to symptoms of depression, those of anxiety may be a risk factor for such dysfunctional behaviors. This result might be considered in light of a primary motivation that has been repeatedly found to trigger drunkorexia, such as the fear of putting on weight because of the calories contained in alcoholic beverages [5, 10]. Anxiety has been conceptualized as a response system, which arises when an event or situation is considered very threatening and dangerous, as it is perceived to be uncontrollable and unpredictable [49]. Thus, adolescents who experience anxiety associated with the fear of putting on weight, may engage in drunkorexia as a way to prevent a situation (the weight gain) perceived as very dangerous and uncontrollable. Indulging in drunkorexia may allow them to gain a sense of control over this feared event and, as a consequence, to reduce anxiety. Indeed, it has been noted [22, 50, 51] that anxiety may represent a risk factor for dysfunctional eating behaviors, such as restrictive eating and compensatory behaviors, as individuals may use such maladaptive eating patterns as a means to reduce anxious symptoms by gaining control over a threatened situation, such as an increase in weight. Specifically, adolescents have been found to use drunkorexia behaviors as an attempt to gain control over their body and, thus, over themselves, engaging in self-imposed rules related to the amounts and the type of food to consume and tending to suppress their internal physiologic feelings of hunger [12, 15]. Therefore, because of their concern that eating too much or eating some types of food (e.g., high-calorie food) may produce an uncontrollable weight gain and lead to a real catastrophe, they may use drunkorexia behaviors to prevent such feared event and find relief from this negative affect.

However, it is worth noting that, although drunkorexia is mostly driven by the fear of increasing in weight, our findings revealed that no correlation appeared between drunkorexia and BMI and any difference between restrictors and no restrictors was found on BMI. These results are consistent with a number of studies [5, 8], which found no relationship between drunkorexia and BMI, and highlighted that adolescents who engage in drunkorexia, tend to frequently consume great quantities of alcohol as they often indulge in binge drinking after restricting food or calories; thus, although they use compensatory behaviors and restrictive eating, they consume a lot of non-essential calories with alcohol beverages, and this data may explain why adolescents who engage in drunkorexia did not show a lower BMI than non-restrictors.

In addition, concerning the hypothesized interaction effects, emotional dysregulation only moderated the relation between anxious symptoms and drunkorexia behaviors, such that adolescents who experienced elevated anxiety and reported high emotional dysregulation were more likely to engage in drunkorexia behaviors. Conversely, at low levels of emotional dysregulation, anxiety did not predict drunkorexia behaviors at all. This data suggests that adolescents who experience high levels of anxiety and have elevated difficulties in regulating emotions are at increased risk to engage in drunkorexia as a way to avoid or reduce such aversive internal states in the absence of more adaptive strategies to cope with negative emotional experiences. Our result is in line with prior research, which showed that adolescents who engage in dysfunctional eating behaviors have difficulties in regulating emotions and tend to use maladaptive strategies, such as emotion suppression, which tend to prolong and amplify negative affect [5, 15, 33]. Indeed, it has

been suggested [33] that experiencing intense and negative emotions and the inability to regulate and express them may increase vulnerability to disordered eating behaviors in adolescents.

Thus, adolescents who experience high anxiety but do not have adequate strategies to deal with their unregulated distress may be more likely to engage in drunkorexia to distract from or reduce such aversive states. In addition, the present study underlined that emotion regulation can also be protective against drunkorexia when adolescents know how to effectively manage their anxiety, even though very strong or intense, and may not turn to food or alcohol as a way to regulate their unacceptable emotions but may use more adaptive and healthy strategies. Thus, this finding supports the argument that better emotion regulation abilities are associated with psychological well-being and good health outcomes and represent a protective factor against adolescent risky behaviors [29, 30, 52].

Limitations and implications for future research

Despite the contribution of our study to the literature regarding drunkorexia, it is important to consider some of the limitations. First, the research involved a school-based convenience sample; therefore, this may limit the generalizability of our results to non-Italian adolescents; further, it might be difficult to generalize our results to adolescents who are experiencing clinical levels of anxiety and depression as any clinical information from participants, expect for BMI, was collected in the study. Second, all data were obtain using self-report instruments, thus, it might be possible that some students have misreported some of the questions of the survey. Third, for the study, a cross-sectional design was used and this limits us form distinguishing the causal relations between the variables; thus, future studies could implement a longitudinal design to better understand the temporal nature of the study variables to increase our knowledge about the role of psychological distress in drunkorexia behaviors. Further, we did not control for the presence of problematic alcohol use and eating psychopathology. As previous studies suggested [5, 8], drunkorexia represents an overlap between eating disorder symptoms and problematic drinking, thus, future research should take into account the assessment of these variables. Finally, we used only the Emotional dysregulation subscale from the EDI-3 to assess emotion regulation difficulties, in line with previous studies [53, 54]. However, research on this topic might include other specific measures to assess different dimensions of emotion dysregulation difficulties. For instance it could be interesting that future research should replicate our findings investigating the moderating role of specific difficulties in emotion regulation (e.g., difficulties in accepting and be aware of emotions). In addition, research on this topic could examine other potential moderators of this relationship, such as, for instance, perfectionism, which may increase the likelihood to exhibit drunkorexia in adolescents with high rates of anxiety, as it relates to concerns about one's physical appearance, and adaptive coping strategies, which, conversely, may be an effective buffer.

Furthermore, our findings have important implications. Specifically, the present study highlighted the relevance to intervene with and prevent drunkorexia behaviors by improving emotion regulation.

Prevention programs should be focused on helping adolescents to manage negative internal states in a functional way; a training on using more adaptive strategies to properly respond to intense and unpleasant emotional situations, especially related to food and body shape, might be of significance. Furthermore, adolescents who engage in drunkorexia, could benefit from cognitive behavioral therapy (CBT), which may help adolescents identifying and challenging thoughts that provoke anxiety and may teach them skills for managing their fears, such as reappraisal, problem solving, and externalization [55, 56]. Thus, if adolescents could learn to deal with their fears in a healthy and adaptive way, they could be less likely to use drunkorexia, as a means to avoid or reduce these unpleasant emotional states. Furthermore, a combination of CBT and medications could also be helpful to manage anxiety especially when elevated [57].

What is already known on this subject?

Although drunkorexia has been proposed as a new form of eating disorders, available literature suggests that it shares several features with existing forms of eating disorders, as well as important risk factors. However, little is known about the relation between drunkorexia and a relevant risk factor for traditional eating disorders, such as psychological distress.

What does this study add?

The present study is of significance in being the first known to examine the relation between psychological distress and drunkorexia among adolescents and to investigate the moderating role of emotional dysregulation in this relation. Specifically, our research provided a contribution on a potential mechanism of association between anxiety and drunkorexia behaviors, such that adolescents who experience elevated anxiety and showed high emotional dysregulation may be at increased risk to turn to drunkorexia to reduce negative emotional experiences as anxiety. Our contribution highlighted the relevance to train adolescents to use more adaptive strategies to regulate and express aversive internal states.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no competing interests.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Approval from the Research Ethics Board of the Department of Developmental and Social Psychology of Sapienza, University of Rome was obtained before data were collected for the current study.

Informed consent Participants gave their informed consent to take part to the study, and for underage students below 18 years, written informed consents were also obtained from parents.

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