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Abstract

Background. A complex and bidirectional association has been assumed between feeding and eating disorders (FEDs) and alcohol consumption. Previous research has demonstrated that alcohol use among individuals with different forms of FEDs is more frequently motivated by two subtypes of internal drinking motives: coping and enhancement motives. Namely, these individuals might use alcohol primarily to regulate internal states, such as to mitigate negative emotions or enhance positive emotions.

Objectives. The present study investigated the mediating role of internal drinking motives on the association between risk for FEDs and alcohol consumption over the effects of relevant covariates, such as depressive symptoms or body mass index (BMI).

Methods. Hungarian data of the European School Survey Project on Alcohol and Other Drugs (ESPAD) from 2015 were used. The final sample included responses from 5457 adolescents (50% males; mean age: 16.62 years). Validated self-report psychometric instruments assessed the level of alcohol use, depressive symptoms and risk for FEDs, and drinking motives.

Results. Risk for FEDs presented a significant positive relationship with internal drinking motives and alcohol use. In the mediation analysis, a significant indirect effect was identified between risk for FEDs and alcohol use via internal drinking motives among females.

Conclusions. Results demonstrated that risk for FEDs was positively associated with internal drinking motives and alcohol use. An indirect effect of risk for FEDs on alcohol consumption via internal drinking motives was discriminated over the impact of depressive symptoms. However, the latter relationship was only found among females which may underline the gender differences in FEDs.

41 **Keywords:** feeding and eating disorders; drinking motives; gender differences; adolescents;
42 alcohol consumption; alcohol comorbidity

1. Introduction

According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the category of feeding and eating disorders (FEDs) is a heterogenous group of disorders defined by psychological and physiological difficulties related to eating behavior or appetite. The diagnostic category of FEDs includes various distinct disorders, such as anorexia nervosa, avoidant/restrictive food intake disorder, binge eating disorder, bulimia nervosa, pica, and rumination disorder (APA, 2013). Pre-adolescence and adolescence are considered as crucial developmental phases due to the progression of various risk behaviors, such as development of clinical and sub-clinical forms of FEDs (Pearson, Riley, Davis, & Smith, 2014). Approximately 3.7% of adolescents are affected with any form of clinical level FED (Flament et al., 2015). However, an even higher proportion of adolescents show sub-threshold or sub-clinical types of FEDs (e.g., 6.1% for bulimia nervosa, 4.6% for binge eating disorder) (Stice, Marti, Shaw, & Jaconis, 2009). Females generally show higher prevalence rates for various forms of FEDs during adolescence (Croll, Neumarksztainer, Story, & Ireland, 2002; Kjelsås, Bjørnstrøm, & Götestam, 2004), while it has also been reported that incidence rates of any forms of FEDs might increase until around the age of 16-17 years during adolescence (Javaras et al., 2015). Among adolescents, various symptom of FEDs (e.g., drive for thinness, bulimic symptoms) are associated with higher rates of body mass index (BMI) (Fan et al., 2010). Sub-threshold forms of different FEDs during adolescence constitute a risk for experiencing increased symptom severity or clinical forms of different FEDs later in adulthood (Neumark-Sztainer, Wall, Larson, Eisenberg, & Loth, 2011). Furthermore, subclinical forms of FEDs are also associated with higher rates of co-occurring psychopathological symptoms, such as symptoms of depression or anxiety (Herpertz-Dahlmann et al., 2015; Touchette et al., 2011). In the present study, the term of “risk for feeding and eating

disorders (FEDs)" is applied to reflect general and non-specific FED-related symptom severity which might indicate a higher risk for having some forms of FED in absence of formal clinical diagnosis (Richter, Strauss, Braehler, Adametz, & Berger, 2017).

Co-occurrence of different forms of FEDs and substance misuse has been consistently reported in previous studies. Symptoms of different types FEDs are associated with alcohol use among treatment-seeking and non-treatment-seeking adolescents (Arias, Hawke, Arias, & Kaminer, 2009; Baker et al., 2018). More specifically, a higher severity of anorexia nervosa or bulimia nervosa symptoms among adolescents has been associated with more severe patterns of alcohol consumption (e.g. more frequent intoxication), more adverse social and psychological consequences (e.g. higher level of alcohol-related physical symptoms) (Arias et al., 2009; Castro-Fornieles et al., 2010). Within the cluster of FEDs, bulimic characteristics, such as binge eating or purging, have shown a more robust association with alcohol use compared to restrictive FED features such as anorexia nervosa (Baker et al., 2017; Gregorowski, Seedat, & Jordaan, 2013). Longitudinal findings have suggested that symptoms of alcohol misuse develop subsequently with the onset of FEDs rather than the other way around (Baker, Mitchell, Neale, & Kendler, 2010; Franko et al., 2005).

One explanation concerning the co-occurrence of different forms of FEDs and elevated levels of alcohol use is that they share underlying emotional risk mechanisms, such as elevated reward sensitivity and negative affect dysregulation (Schulte, Grilo, & Gearhardt, 2016; Stewart, Brown, Devoulyte, Theakston, & Larsen, 2006). In the cases of reward-seeking behaviors, individuals seek reinforcing activities, such as using alcohol or binge eating in order to enhance positive emotions, and they perceive these behaviors as highly pleasant (Birch, Stewart, & Brown, 2007; Dawe & Loxton, 2004; Schulte et al., 2016). Related to the 'self-medication' concept, it has been assumed

that different forms of FEDs (e.g. binge eating disorder) and alcohol consumption occur as a coping response with the aim of mitigating negative affect (Birch et al., 2007; Cook, Wonderlich, & Lavender, 2014; Stewart et al., 2006). Alternatively, the impulsivity facet of negative urgency might also play an important role, which is the tendency to act rashly when experiencing negative affective states. Individuals with high level of negative urgency are likely to engage in the aforementioned risk behaviors impulsively when experiencing negative emotions (Fischer, Anderson, & Smith, 2004).

The aforementioned positive and negative reinforcement mechanisms are also represented in interrelated motives for FEDs (e.g. binge eating disorder) and alcohol use (Luce, Engler, & Crowther, 2007). Due to the aforementioned similar risk characteristics of emotion regulation, individuals who show risk for FEDs might be more likely consume alcohol because of positive and negative reinforcement mechanisms in terms of affective states. Within the framework of the motivational model of alcohol use (Cooper, 1994), it is expected that alcohol consumption is more likely to be motivated by internal motives for those who show a risk for FEDs. Namely, these individuals might use alcohol more frequently in order to regulate their internal or affective states, such as to mitigate negative affect (coping motives) or enhance positive emotions (enhancement motives). To date, only a few studies have investigated the relationship between different forms of FEDs and drinking motives (Anderson, Simmons, Martens, Ferrier, & Sheehy, 2006; Luce et al., 2007; Mikheeva & Tragesser, 2016). Based on these findings, individuals with different forms of FEDs, such as bulimia nervosa or binge eating disorder, have shown higher levels of coping motives for drinking.

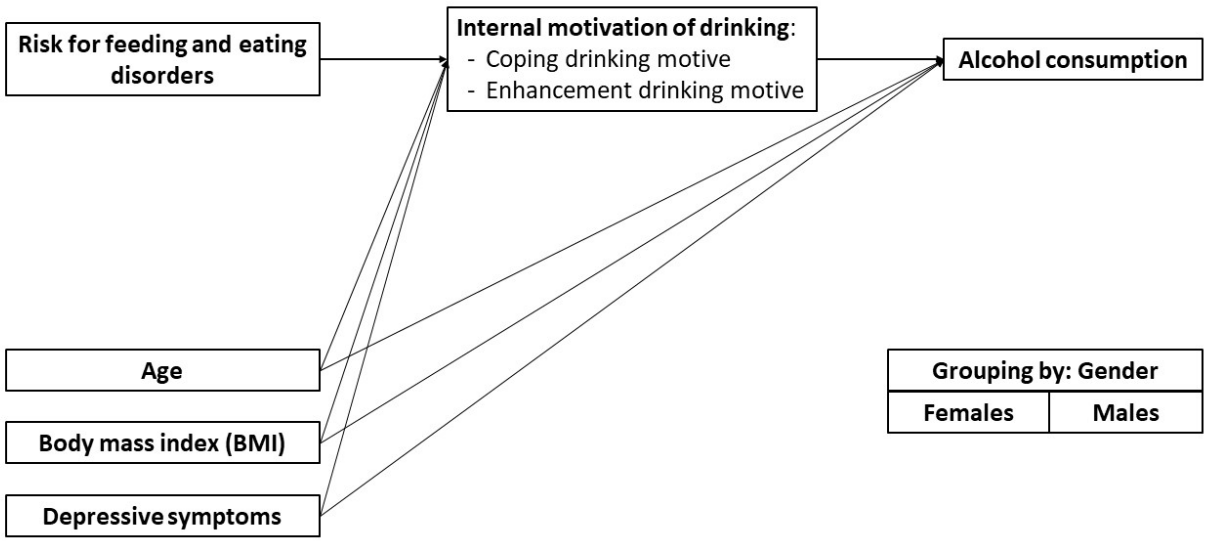

Figure 1. *Hypothesized conceptual model related to the association between risk for FEDs and alcohol consumption*

The present study aimed to obtain a more comprehensive understanding of the interrelations between risk for FEDs, drinking motives, and alcohol use. A conceptual model was hypothesized and tested (Figure 1) where the association between risk for FEDs and alcohol consumption would be mediated by internal drinking motives. It was assumed that alcohol use among adolescents who show higher risk for FEDs would be driven by coping (e.g., drinking to forget about problems) and enhancement motives (e.g., drinking because it is exciting) to a greater extent, which subsequently contribute to more severe forms of alcohol consumption (Anderson et al., 2006; Birch et al., 2007; Luce et al., 2007). Therefore, based on the aforementioned theoretical considerations (i.e., shared, positive and negative affective reinforcement mechanisms which might explain the co-occurrence of different forms of FEDs and elevated levels of alcohol use, and their implications for the

motivational background of alcohol use), the present study primarily assessed the mediating role of internal motives (i.e., using alcohol to regulate internal or affective states) between risk for FEDs and alcohol use. Due to this, the indirect effects of risk for FEDs on alcohol consumption via external motives (i.e., social and conformity motives) were only investigated as supplementary analyses. It was expected that the effect of risk for FEDs on alcohol consumption would be separately demonstrable among males and females over the co-occurring effect of depressive symptoms (Herpertz-Dahlmann et al., 2015; Touchette et al., 2011) as well as after considering the possible covariance between age, BMI, and risk for FEDs (Javaras et al., 2015, Fan et al., 2010). To the best of the authors' knowledge, no previous study has examined the potential mediating role of drinking motives between risk for FEDs and alcohol consumption.

2. Methods

2.1. Participants and procedure

The present study's data derived from the Hungarian data of the European School Survey Project on Alcohol and Other Drugs (ESPAD) from 2015. The aim of the ESPAD study is to collect data on adolescents' tobacco, alcohol, and other substance use to facilitate temporal and cross-national comparisons (Elekes, 2016). The target population of this study consisted of ninth- and tenth-grade students in general and vocational secondary schools (i.e., 16 year old students born in 1999). Stratified cluster sampling was applied to assure representativeness of the sample in terms of geographic region, grade, and school type. In total, 7% of the selected schools declined to participate in the study. The study of the ESPAD 2015 Hungary comprised data from 6,664 students. Data from 443 students were excluded from the analyses due to an invalid questionnaire or inconsistent response patterns. Only data were considered for the final analyses from those adolescents who reported alcohol consumption in their lifetime. Consequently, data from further

764 participants were excluded from the analyses because of lifetime abstinence of alcohol consumption. Therefore, the final sample included responses from 5,457 participants (proportion of males: 50.0% [n=2731]; mean age=16.62 [SD=0.94]; mean BMI=21.66 [SD=3.78]).

2.2. Measures

2.2.1. Alcohol consumption. Six alcohol consumption-related items were selected for the analyses to reflect frequency of alcohol use (ESPAD Group, 2016). Frequency of alcohol use and drunkenness were assessed during the past 12 months and 30 days using a seven-point frequency scale (*1=0 times, 7=40 or more times*). The level of binge drinking was also taken into account: individuals had to assess how frequently they consumed at least five drinks in one occasion during the past 30 days on a six-point scale (*1=0 times, 6=10 or more times*). Finally, participants estimated on a ten-point scale the level of self-reported drunkenness on the last occasion when they consumed alcohol (*1=Alcohol did not have an effect; 10=I was very drunk, I did not remember what happened to me*). The level of alcohol consumption was represented by a composite continuous latent variable which was defined by the aforementioned observed alcohol use indicators (ω=0.89). Illustration of the construction of the continuous one-factor latent variable assessing alcohol use and factor loadings related to the observed indicators are presented in Supplementary Figure 1. Previous studies have also applied similar approach and assessed the level of alcohol consumption by a continuous unidimensional latent factor based on various observed indicators of alcohol use (Källmén., Berman, Jayaram-Lindström, Hammarberg, & Elgán, 2019; LaBrie, Lac, Kenney, & Mirza, 2011; Sher, Wood, Wood, & Raskin, 1996).

2.2.2. Center of Epidemiological Studies Depression-Scale (CES-D). Depressive symptomatology was assessed using the short form of the CES-D-Scale (Original version: Kokkevi & Fotiou, 2009; Hungarian version: Demetrovics, 2007). It comprises six items reflecting various symptoms of

depression during the past seven days, such as concentration issues and mood disturbances. Adolescents had to provide responses for each question on a four-point scale (*1=nearly never; 4=nearly always*). The scale presented a good level of internal consistency in the present sample (α=0.84). Depressive symptoms were specified as one-factor latent variable in the present analyses (ω=0.89).

2.2.3. Drinking Motives Questionnaire – Short Form (DMQ-SF). Participants' reasons for using alcohol was assessed using the 12-item shortened version of the DMQ (Original version: Kuntsche & Kuntsche, 2009; Hungarian version: Németh, Kuntsche, Urbán, Farkas, & Demetrovics, 2011). The instrument originally assessed four types of drinking motives: (i) coping, (ii) conformity, (iii) enhancement, and (iv) social motives. Students answered each item on a five-point scale (*1=never; 5=always*). Based on predominantly theoretical considerations, only internal (i.e., coping and enhancement) motives were involved in the current analyses related to the hypothesized conceptual model. A good level of internal consistency was demonstrated related to the two selected subscales of the DMQ in the present sample (enhancement: α=0.82; coping: α=0.89).

However, due to the extremely high level of correlation between coping and enhancement motives (r=0.86), it was not possible to include both factors of internal drinking motives separately in the analysis. Therefore, in the mediation analysis, a latent factor of 'internal drinking motives' was specified which incorporated items of the coping and enhancement subscales (ω=0.94). Consequently, this factor represented motives of general affect regulation for alcohol consumption irrespective of their valence. In line with this, previous studies have also underlined that enhancement and coping drinking motives are not distinct but rather more combined constructs, and it is hard to separate them at within-person level (Goldstein & Flett, 2009). Similarly, other

studies have suggested the existence of a broad and non-specific construct of drinking motives (Lac & Donaldson, 2017; Urbán, Kökönyei, & Demetrovics, 2008).

2.2.4. SCOFF Questionnaire. In order to assess the risk for FEDs among respondents, the SCOFF questionnaire was used (original version: Morgan, Reid, & Lacey, 1999; Hungarian version: Dukay-Szabó et al., 2016). The scale was originally designed to screen for FEDs. It contains five items which reflect on the core symptoms of anorexia nervosa and bulimia nervosa. The name of the questionnaire is an acronym reflecting on the content of the symptoms included in the scale (e.g., letter *'C'* – for 'control' – denotes worrying about losing **c**ontrol over eating). Participants had to decide in the case of each item if it was true for themselves or not (*0=no; 1=yes*). Traditional measure of reliability presented inadequate degree of internal consistency in the present sample (α=0.55). Previous studies also reported inadequate α levels for the SCOFF because it contains small number of items and its items represent symptoms of disparate disorders (Burton, Abbott, Modini, & Touyz, 2015; Garcia et al., 2010). In order to overcome this problem, risk for FEDs was defined as a one-factor latent variable in the present analysis (ω=0.78). Previous studies using confirmatory factor analysis and item response theory analysis have also supported the unidimensional latent structure of the questionnaire (Bean, 2019; Richter et al., 2017).

2.3. Data analysis

Structural equation modeling (SEM) was performed to examine the indirect effect of risk for FEDs on alcohol use via internal drinking motives. The analysis was performed separately for males and females in order to control the possible gender-related differences in terms of FEDs (Croll et al., 2002). The effects of age, BMI, and depressive symptoms were also taken into account during the analyses. Because comorbidity might be present between different forms of FEDs and depressive symptoms among adolescents (Santos, Richards, & Bleckley, 2007), it was necessary to distinguish

the effects of risk for FEDs on drinking motives and alcohol use outcomes from those of depressive symptoms. In the mediation analysis, risk for FEDs and depressive symptoms, internal drinking motives, and level of alcohol consumption were specified as a continuous one-factor latent variables. Total, direct, and indirect effects of risk for FEDs on alcohol use via internal drinking motives were assessed.

Supplementary analyses were also conducted to separately test the mediating effect of each drinking motive between risk for FEDs and alcohol consumption. Although due to theoretical considerations the present study did not aim to examine the mediating role of external drinking (i.e., conformity and social) motives between risk for FEDs and alcohol use, interested readers can investigate these findings in Supplementary Figure 2A-D. Moreover, additional supplementary analyses also demonstrated that if the effect of highly correlating drinking motives (e.g., relationship among social, enhancement, and coping motives: r=0.70-0.88) were simultaneously included in the mediation model, conformity and enhancement motives presented negative relationships with alcohol consumption which are considered as a statistical artefact (i.e., negative suppressor effects). This was indicated because of the significant and positive associations which were demonstrated between drinking motives and alcohol consumption in mediation models separately containing each of the drinking motives. These latter results are in line with previous literature findings and theoretical considerations indicating that higher levels of drinking motives can predict higher rates of alcohol use (Crutzen, Kuntsche, & Schelleman-Offermans, 2013). Previous studies have also reported similar negative suppressor effects due to the high level of correlation between factors of drinking motives, especially in the case of conformity motives (Németh et al., 2011).

Except for the variable assessing the level of drunkenness on the last occasion, all indicator variables of the continuous latent variables were specified as categorical observed variables. The model estimation was based on the Weighted Least Squares Mean and Variance (WLSMV) technique. Degree of model fit was determined based on various model fit indices. Optimal level of model fit was indicated by values of at least 0.90-0.95 in the case of the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI). A value below 0.05 of the of Root Mean Squared Error of Approximation (RMSEA) index marks an adequate model fit. All analyses used weighted data to ensure representativeness of the sample. Moreover, cluster effect due to class-based sampling and possible non-independence of the observations within each cluster was also modeled. Analyses were performed using MPlus 8.0 (Muthén & Muthén, 2017) and IBM SPSS Statistics 23.0 software. For preliminary analyses conducted by using the latter software, missing data were handled by listwise deletion, while for SEM analyses conducted by MPlus 8.0, pairwise deletion was applied to handle missing data.

3. Results

3.1. Preliminary analyses

Table 1 presents the prevalence of alcohol use-related indicators and risk for FEDs in the total sample, and among males and females. Except for alcohol consumption status in the past 12 months, males presented significantly higher odds for engaging in each alcohol consumption-related outcomes compared to females. Females demonstrated approximately three times higher odds for having a risk for FEDs compared with males.

Additional analyses revealed that those individuals who reported of having symptoms of making themselves feeling uncomfortably full, recently losing more than one stone in weight, and believing

themselves to be fat when others say they are too thin consistently, showed significantly higher odds of engaging in various alcohol consumption-related outcomes, such as alcohol consumption, drunkenness and binge drinking in the past 30 days, and drunkenness in the past 12 months (Supplementary Table 1).

Table 1. *Prevalence of alcohol use-related indicators and risk for FEDs in the total sample, and among males and females*

	Total sample *N* (%)	Males *N* (%)	Females *N* (%)	χ^2 (*p*)	OR [95% CI]
Alcohol consumption in the past 12 months	5081 (93.75%)	2539 (93.76%)	2542 (93.73%)	<0.001 (0.966)	1.00 [0.81-1.25]
Alcohol consumption in the past 30 days	3531 (65.08%)	1826 (67.36%)	1703 (62.75%)	12.66 (<0.001)	**1.22 [1.10-1.37]**
Drunkenness in the past 12 months	2816 (52.46%)	1480 (55.35%)	1335 (49.55%)	18.06 (<0.001)	**1.26 [1.13-1.40]**
Drunkenness in the past 30 days	1185 (22.05%)	635 (23.71%)	550 (20.40%)	8.57 (0.003)	**1.21 [1.07-1.38]**
Binge drinking in the past 30 days	2613 (47.89%)	1426 (52.23%)	1187 (43.54%)	41.28 (<0.001)	**1.42 [1.27-1.58]**
Risk for FEDs[1]	1384 (26.39%)	411 (15.79%)	973 (36.83%)	298.78 (<0.001)	**0.32 [0.28-0.37]**

Note. χ^2: Chi square statistics representing comparisons between males and females. OR: Odds Ratio. 95% CI: 95% Confidence Interval for Odds Ratios. Odds ratios in bold are significant at least $p<0.05$ level. In each comparison, females were specified as the reference category. [1] Risk for FEDs was determined by using the threshold of the SCOFF questionnaire: at least two positive responses on the instrument was assessed as a case for having a risk for FEDs. Number of missing cases in the total sample in the order of the variables presented in the first column: *N*=37; *N*=31; *N*=89; *N*=83; *N*=1; *N*=212. Number of missing cases in gender-based comparisons in the order of variables presented in the first column: *N*=37; *N*=32; *N*=91; *N*=83; *N*=1; *N*=212.

3.2. Testing the indirect effect of risk for FEDs on alcohol consumption via drinking motives

SEM was conducted separately for males and females to test the indirect effect of risk for FEDs on alcohol consumption via internal drinking motives. Bivariate correlations between the variables are displayed in Table 2. For interested readers, Supplementary Figure 2 contains results of these analyses which were performed to test the mediating effect of each drinking motives separately between risk for FEDs and alcohol consumption.

Table 2. *Correlation coefficients between latent and observed study variables among males and females*

	1.	2.	3.	4.	5.	6.
1. Age	-	**0.09**	0.05	**0.09**	**0.17**	**0.22**
2. BMI	0.01	-	0.04	**0.37**	0.03	**0.07**
3. Depressive symptoms	-0.04	0.03	-	**0.21**	**0.27**	**0.17**
4. Risk for FEDs	-0.01	**0.31**	**0.45**	-	**0.17**	**0.09**
5. Internal drinking motives	**0.09**	0.02	**0.37**	**0.35**	-	**0.66**
6. Alcohol consumption	**0.16**	0.03	**0.24**	**0.23**	**0.69**	-

Note. Significant ($p < 0.05$) correlation coefficients are in bold. Correlation coefficients above the diagonal are assessed among males (N=2807), while correlation coefficients below diagonal are assessed among females (N=2796). Missing data statistics are equivalent to the data presented in Figure 2.

Regression path coefficients between the predictor and outcome variables are shown in Figure 1A for females and in Figure 1B for males. Optimal level of model fit was presented for males and females. For both gender groups, in the final model the regression path coefficient between depressive symptoms and alcohol use was fixed at 0 in order to avoid negative suppressor effects (unconstrained β for males=-0.06, p=0.006; unconstrained β for females=-0.11, p=0.002). Risk for FEDs and depressive symptoms presented a significant and positive predictive effect on internal drinking motives among males and females. The direct effect between risk for FEDs and alcohol

use was non-significant in both groups. The latent variable of internal drinking motives demonstrated a significant, positive and strong relationship with alcohol consumption irrespective of gender. Distal predictors partly explained the higher amount of the variance related to the latent factor of internal drinking motives among females. It was assumed that this difference was due to the slightly stronger relationship between ED symptoms and internal drinking motives among females (B [95% CI] for males=0.13 [0.05-0.21], B [95% CI] for females=0.28 [0.18-0.38]). The gender-based models explained 45.5-49.0% of the variance of alcohol consumption.

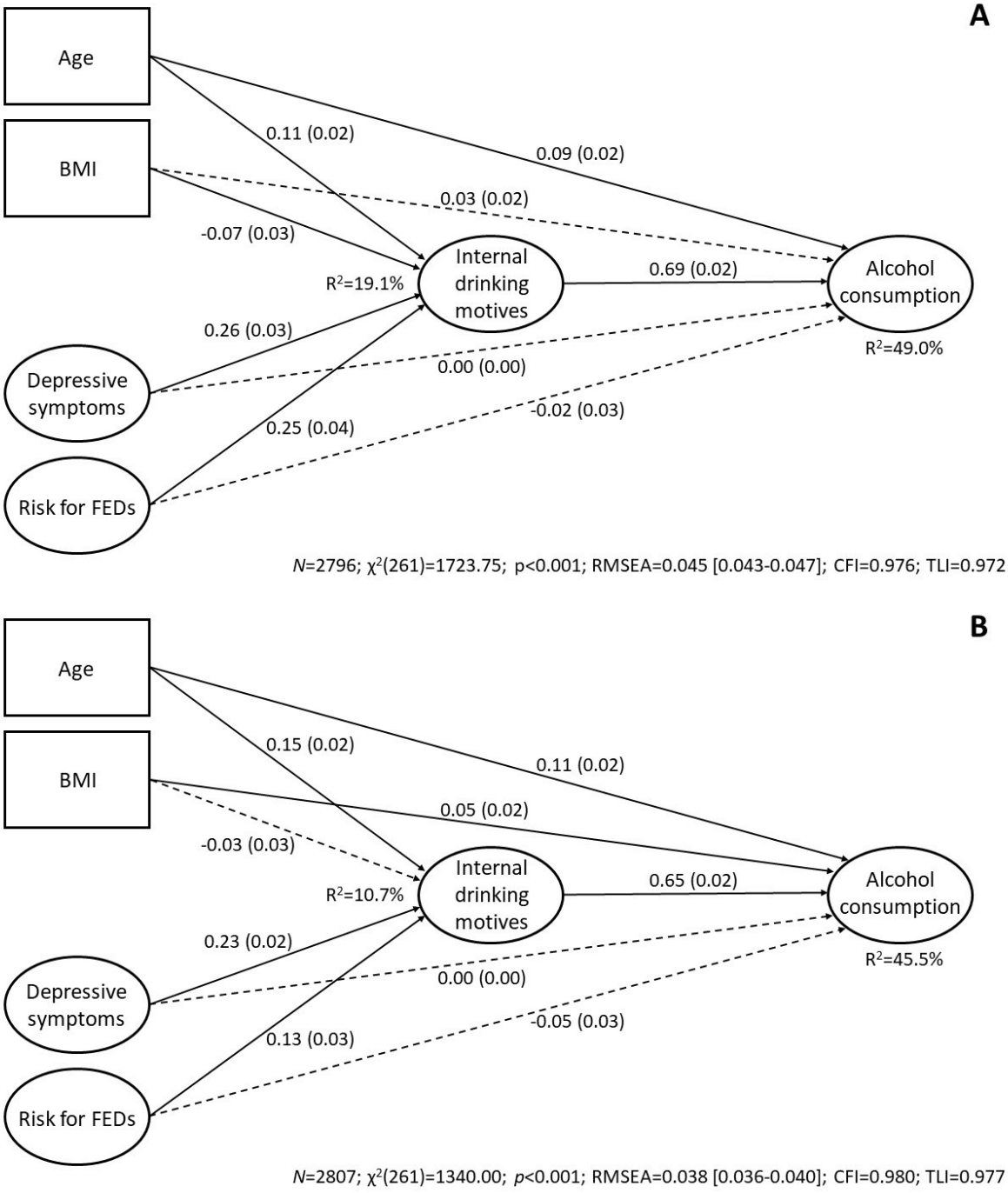

Figure 2. *Standardized regression coefficients representing the association between risk for FEDs, internal drinking motives and alcohol consumption among females (A) and males (B)*

Note. Figure 2A presents findings among females, while Figure 2B presents findings among males. Solid lines represent significant (p<0.05) standardized (β) regression coefficients. Dashed lines

represent non-significant (p>0.05) standardized (β) regression coefficients. Related to each regression coefficients, standard error (S.E.) values are presented in brackets. Regression coefficient between depressive symptoms and alcohol consumption was fixed at 0. Number of missing data patterns among females: N=97. Covariance coverage among females: mean covariance coverage=96.2% Range of covariance coverage=92.7%-100.0%. Number of missing data patterns among males: N=107. Covariance coverage among males: mean covariance coverage=94.9%. Range of covariance coverage=90.8%-99.9%.

Effect size indices relating to the total, direct, and indirect effects from risk for FEDs upon alcohol consumption are shown in Table 3. The total effect of risk for FEDs on alcohol use was significant among females, but it was non-significant for males. Therefore, for males, the indirect effect from risk for FEDs to alcohol consumption was not estimated. Among both genders, the direct effect of risk for FEDs did not remain significant after taking into account the effect of drinking motives. The indirect effect was significant via internal drinking motives among females. Therefore, higher risk for FEDs predicted higher level of internal drinking motives which subsequently contributed to elevated rates of alcohol consumption. This indirect effect was demonstrated over the influence of depressive symptoms.

Table 3. *Standardized and unstandardized effect size indices related to the total, direct and indirect effects from risk for FEDs to alcohol consumption among males and females*

	Males		Females	
	B (S.E.)	β (S.E.)	B (S.E.)	β (S.E.)
Total effect	0.05 (0.05)	0.03 (0.04)	**0.22 (0.05)**	**0.16 (0.04)**
Direct effect	-0.07 (0.05)	-0.05 (0.03)	-0.02 (0.05)	-0.02 (0.03)
Indirect effect through internal drinking motives	-[1]	-[1]	**0.24 (0.04)**	**0.17 (0.03)**

Note. Unstandardized (B) and standardized (β) effect size measures presented with bold figures are significant at least $p<0.05$ level. [1]Indirect effect from risk for FEDs to alcohol consumption was not estimated among males due to non-significant total effect.

4. Discussion

The present study investigated the complex relationship between risk for FEDs, internal drinking motives, and alcohol use. The main aim of the study was to investigate the mediating effect of internal drinking motives in the association between risk for FEDs and alcohol use. To the best of the authors' knowledge, this is the first time that the complex relationship between risk for FEDs, drinking motives, and alcohol use has been examined among adolescents. According to the results of the present study, the association between risk for FEDs and alcohol consumption was mediated by internal drinking motives among females. Supporting the hypothesized conceptual model of the study, the indirect effect including internal drinking motives demonstrated that more severe risk for FEDs predicted higher level of drinking motives which enhanced positive or mitigated negative emotions, which subsequently contributed to elevated rates of alcohol consumption. This indirect effect was present while controlling for the effect of depressive symptoms.

This result is in line with previous research findings emphasizing the occurrence of high level of coping drinking motives among participants with different forms of FEDs, such as bulimia nervosa or binge eating disorder (Anderson et al., 2006; Luce et al., 2007; Mikheeva & Tragesser, 2016). The present outcomes also fit the theoretical considerations which have attempted to identify similar features of problematic alcohol use and different forms of FEDs. These studies assumed that problematic forms of eating behavior (e.g. binge eating) and alcohol use might be motivated by alleviating negative emotions (Cook et al., 2014; Stewart et al., 2006). Moreover, the mediational model supported the assumption that adolescents with higher risk for FEDs might

engage in more heavy forms of alcohol consumption in order to experience more pleasant internal states (Dawe & Loxton, 2004; Schulte et al., 2016). However, it is important to note that it was not possible to assess the contribution of coping and enhancement motives separately due to their strong correlation. Therefore, reasons which mitigated negative (e.g., using alcohol to cheer up when an individual is in a bad mood) or enhanced positive emotions (e.g., using alcohol because it is exciting) overlapped greatly among adolescents. Internal drinking motives represent general affect regulation reasons for alcohol consumption (Goldstein & Flett, 2009). The strong positive relationship between internal drinking motives and alcohol use is in accordance with previous studies which suggested that higher levels of enhancement and coping motives are associated with more harmful alcohol use outcomes (Kuntsche, Knibbe, Gmel, & Engels, 2005) The present research focused primarily on drinking motives which emphasize the emotion regulation aspect of alcohol use, therefore, external drinking motives, such as social and conformity motives, were not included in the mediation model testing the hypothesized conceptual model. However, previous research data presented evidence that, among treatment-seeking individuals with co-occurring alcohol-related problems and binge eating, alcohol use might occur in a social context as well, therefore it is not induced by motives of emotion control only (Birch et al., 2007). In line with this, supplementary analyses showed that when the mediating effects of drinking motives were examined separately, significant indirect effects of risk for FEDs on alcohol consumption via conformity motives among males and females and via social motives among females were found.

It is important to highlight that a different pattern of findings was observed for males and females in the mediation analyses. The total effect of risk for FEDs on alcohol consumption was only significant among females, as well as the indirect effect via internal drinking motives, which was also only significant among females. These findings suggest that the self-medicating role of alcohol

use among individuals with a higher risk for FEDs was only demonstrated among females. These different patterns might be explained by gender-specific variations in FEDs. Previous studies have reported that females show a higher symptom severity of some forms of FEDs (e.g. weight or shape concerns, restraint), while males present a higher age of onset for FEDs, and different patterns of symptomatology (e.g., higher tendencies for excessive exercise as a compensatory mechanism, or muscular ideal of the body). In addition, females with different forms of FEDs might show elevated rates of comorbid mood disorders, and experience higher levels of distress related to their symptomatology (Kinasz, Accurso, Kass, & Le Grange, 2016; Murray et al., 2017). Also, different pattern of findings between males and females might be explained by drinking motive-specific differences among adolescents. During early adolescence, females are more likely to drink due to coping motives, while it is also possible, that adolescent males with a risk for FEDs show a higher tendency for motives with positive valence, such as social motives, which might play a more important role in predicting alcohol use among them (Kuntsche et al., 2006).

4.1. Limitations and future directions

The present results should be interpreted cautiously due to various limitations. First, because of the cross-sectional nature of the study, it was not possible to explore causal relationships between the variables examined. Because the mediational model was unable to control for bidirectional relationships, future studies should use longitudinal or ecological momentary assessment (EMA) design in order to obtain a more accurate picture of the interrelationship between the variables (Pisetsky et al., 2016). Second, the present findings might not provide a comprehensive representation of the associations between risk for FEDs and alcohol use, because important predictor variables, such as negative urgency (Fischer, Settles, Collins, Gunn, & Smith, 2012), were not included in the mediational model. Third, from a psychometric assessment perspective,

399 the SCOFF questionnaire provided a non-differentiated measurement of a risk for FEDs which may
400 have biased the present results. The broad diagnostic category of FEDs includes both
401 heterogeneous and distinct disorders which show disparate symptomatology, such as restricting
402 type of anorexia or binge eating disorder. By using the SCOFF questionnaire, the present study
403 was only able to superficially assess some core symptoms of anorexia nervosa and bulimia nervosa.
404 Furthermore, while multiple possible diagnostic categories might be simultaneously related to each
405 item of the questionnaire and some disorders (e.g., binge eating disorder) within the cluster of
406 FEDs, they are not covered entirely by the SCOFF. Although the study aimed to assess a general
407 and non-differentiated construct of a risk for FEDs, it is important to consider that FEDs are not a
408 single syndrome and in-depth exploration of symptomatology of divergent disorders within the
409 diagnostic category of FEDs. Furthermore, previous findings indicated that individuals in different
410 diagnostic categories within the cluster of FEDs show different motives for substance use (Baker
411 et al., 2010). Therefore, future studies need to examine (e.g., separately for individuals with
412 anorexia nervosa and bulimia nervosa) the mediating role of drinking motives between different
413 types of FEDs and alcohol use by specific diagnoses. Fourth, the present study only limitedly
414 assessed the unique contribution of each drinking motive. Future studies should explore the
415 relationship between risk for FEDs and alcohol use by simultaneously assessing indirect effects
416 related to each subscale of drinking motives. Finally, the present study assessed patterns of alcohol
417 consumption in an overall manner. Therefore it did not address investigating the varying effects of
418 risk for FEDs on different indicators of alcohol use (e.g., alcohol consumption in the past 12 months
419 or binge drinking), or membership of alcohol consumption-based subgroups (e.g., latent classes
420 characterized with frequent alcohol use with small quantities and high quantities).

421 **5. Conclusions**

The present study investigated the indirect effect of risk for FEDs on alcohol consumption via drinking motives. Overall, the findings suggested that risk for FEDs were positively associated with internal drinking motives and alcohol use among males and females. It was possible to discriminate for females an indirect effect of risk for FEDs on alcohol consumption via internal drinking motives over the impact of depressive symptoms. Consequently, these findings fit previous data proposing a positive relationship between different symptoms of FEDs (e.g. purging, bingeing) and problematic alcohol use among adolescents (Arias et al., 2009; Kirkpatrick et al., 2019), and correspond with the assumption that individuals with a higher levels for restrained and disinhibited FED-related behaviors show a greater tendency for preoccupation with alcohol-related cognitions and prompts (Higgs & Eskenazi, 2007). Because individuals with co-occurring FEDs and heavy alcohol use might be at risk to experience more severe consequences due to alcohol consumption, treatment and prevention programs among treatment-seeking and non-treatment seeking adolescents should take into account and explore the role of drinking motives. Drinking motives are considered as important proximal predictors of alcohol use, therefore intervening at the level of drinking motives might subsequently contribute to less severe levels of alcohol use. Interventions working with adolescents showing a risk for FEDs might (i) provide personalized feedback for these individuals in terms of their drinking motives, (ii) help to identify high-risk situations of alcohol use when experiencing intense positive and negative emotions, (iii) introduce alternative strategies to regulate their positive and negative affect states instead of alcohol use, and (iv) train alcohol use-related protective or refusal skills for them when experiencing intense positive and negative emotions (Carey, Scott-Sheldon, Carey, & DeMartini, 2007).

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