


## BRIEF REPORT

# Examining associations between symptoms of eating disorders and symptoms of anxiety, depression, suicidal ideation, and perceived family functioning in university students: A brief report

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## Abstract

**Objective:** We examined the relationships between eating disorders symptoms (EDs), suicidal ideation, depressive and anxiety symptoms, and perceived family functioning in a sample of university students aged 18–25 years ( $N = 397$ ).

**Method:** Assessment of symptoms was carried out with the Eating Disorder Diagnostic Scale, Beck Anxiety Inventory and Beck Depression Inventory, among others. We explored the associations between the domains using network analysis.

**Results:** We found that physical anxiety symptoms, followed by cognitive and physical depressive symptoms showed the greatest centrality in the current network. Perceived family functioning was negatively related to eating disorder symptoms.

**Discussion:** We provide evidence regarding the relevant role of anxiety and depression symptoms in the presentation of ED symptoms in university students. These findings provide new insights to improve preventive interventions to timely reduce symptoms and risk factors associated with EDs.

**Public significance:** Using a network approach, we found specific associations between physical anxiety symptoms, cognitive and physical depressive symptoms, eating disorders symptoms, suicidal ideation and perceived family functioning in university students. These variables can be potential targets to develop evidence-based preventive strategies in this population. A better understanding of these complex associations and the role of family variables could enhance the effectiveness of interventions in both clinical and educational settings.

## KEYWORDS

anxiety, depression, feeding and eating disorders, perceived family functioning, suicidal ideation, university students

## 1 | INTRODUCTION

Prevalence of eating disorders (EDs) ranges up to 6.13% in Latin-American countries (Kolar et al., 2016). EDs are comorbid with psychiatric symptoms including anxiety and depression (Black-Becker

et al., 2014; Cruz et al., 2015), and other negative outcomes such as suicide related behaviors (SRB) (Batta, 2019; Smith, Zuromski, & Dodd, 2018) and suicide mortality (Chesney et al., 2014). These associations are common in both university students with EDs (Goel et al., 2018) and those at risk for EDs (Chang et al., 2015). For

instance, Lipson and Sonnevile (2019) found that recent weight loss and body dysmorphia were associated with suicidal ideation (SI) in college students, and Nascimento et al. (2019) observed that proneness to attempt suicide was higher in students at risk for EDs or with symptoms suggestive of depression.

A promising approach to examining these associations is network analysis (Levinson et al., 2022; Monteleone & Cascino, 2021). Although prior network studies analyzing ED symptoms have focused on links with anxiety and depressive symptoms (Levinson et al., 2017; Smith, Mason, et al., 2018), few studies have done so on Latin-American populations, particularly in non-clinical and college samples (Tavolacci et al., 2020), where ED symptoms (Smink et al., 2012) and SRB are prevalent (Pillay, 2021). However, family variables, reported as associated with EDs (Cerniglia et al., 2017), have not been examined using this approach. Given the high prevalence of ED in university students (Fitzsimmons-Craft et al., 2019) and the need for new insights to improve preventing strategies (Le et al., 2017), we aim to examine the associations between ED symptoms, anxiety (AS), and depressive symptoms (DS), suicidal ideation (SI) and perceived family functioning (FF) in a sample of university students. In line with previous findings (Monteleone et al., 2019; Solmi et al., 2018), we hypothesized that DS, AS would be central in the overall network. Moreover, we hypothesized that FF would be associated with both ED symptoms and SI.

## 2 | MATERIALS AND METHODS

### 2.1 | Participants

We conducted a cross-sectional study with 397 university students (M age = 20.5%,  $SD = 1.76\%$ , women = 80.1%) from Universidad Adventista, Chile, recruited in 2018. The inclusion criteria were that the students voluntarily agreed to participate in the study and signed written and informed consent. Questionnaires were completed in person. Participants were not compensated for their involvement. Three students who did not complete all measures were excluded. This study was approved by the Research Ethics Committee (Universidad Adventista, Chile).

### 2.2 | Measures

#### 2.2.1 | Eating disorders

The Eating Disorder Diagnostic Scale (EDDS) (Silva et al., 2012; Stice et al., 2000), is a 22-item self-report questionnaire assessing symptoms of anorexia nervosa, binge eating disorder, a sub-threshold levels for each disorder, and a general level of eating problems. Eight items present dichotomous responses (no = 0/yes = 1) and 10 are Likert type (four from “not at all” to “extremely”; one from “never” to “seven times” and five from “never” to “14 times”). The remaining four items are about weight, height, menstrual period, and contraceptive intake. The score ranges from 0 to 109. It contains three

dimensions: body dissatisfaction (BD), binge-eating behaviors (BEB), and compensatory behaviors (CB). In our sample, reliability for BD ( $\alpha = .88$ ,  $\omega = .89$ ) and BEB ( $\alpha = .80$ ,  $\omega = .80$ ) were good, while for CB ( $\alpha = .58$ ,  $\omega = .57$ ) was close to acceptable.

#### 2.2.2 | Depression

Beck Depression Inventory I (BDI-IA; Beck et al., 1961; Valdés et al., 2017), is a 21-item scale assessing physical depressive symptoms (PDS) and cognitive depressive symptoms (CDS) experienced over the last two weeks. The sum scores to each item (scored 0 to 3) generate a total ranging between 0 and 63 (cutoff = 13.8). In our sample, reliability was excellent for the entire scale ( $\alpha = .92$ ,  $\omega = .93$ ), and good for the CDS ( $\alpha = .80$ ,  $\omega = .82$ ) and PDS ( $\alpha = .75$ ,  $\omega = .76$ ) dimensions.

#### 2.2.3 | Anxiety

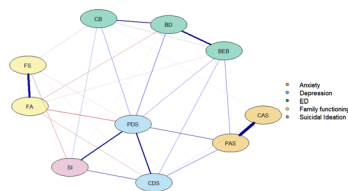
Beck Anxiety Inventory (BAI) (Beck et al., 1988; Cova et al., 2007), is a 21-item measure assessing physical and cognitive anxiety symptoms (PAS and CAS, respectively) experienced over the last two weeks. Answers to each item are on a scale from 0 to 3. The total score ranges between 0 and 63 (cutoff = 16). In our study, the complete measure ( $\alpha = .86$ ,  $\omega = .87$ ), the CAS ( $\alpha = .87$ ,  $\omega = .88$ ), and PAS ( $\alpha = .85$ ,  $\omega = .86$ ) all showed very good reliability.

#### 2.2.4 | Suicidal ideation

Columbia Suicide Severity Rating Scale (C-SSRS) (Núñez et al., 2019; Posner et al., 2011). Items are scored dichotomously (0–1). Severity of SI was rated on a 6-point ordinal scale: 1 = wish to be dead, 2 = non-specific active suicidal thoughts, 3 = thoughts about how to attempt suicide, 4 = suicidal thoughts and intentions, 5 = suicidal thought with detailed plan, and 6 = intentions to conduct plan, resulting in a continuous variable. Frequency of SI was addressed by asking participants when these thoughts happened: ever in life (SIL) and/or during last month (SIM). We only consider SIL, as there were few reports of suicidal ideation during the last month. Scores of 3 and over were considered high SI. In our sample, the reliability of SIL was very good ( $\alpha = .85$ ,  $\omega = .88$ ).

#### 2.2.5 | Perceived family functioning

Family Health Scale (Escala de Salud Familiar; Puschel et al., 2012), is a 13-item self-report assessing an individual's perception regarding their family functioning on two factors: family support (FS) and family agreement (FA). Answers are on a scale from 0 to 6. Total summed score ranges between 0 and 65. A mean score over 3.7 indicates a high infringement of familial positive functioning.



**FIGURE 1** Network model of eating disorders (ED), depression, anxiety, perceived family functioning and suicidal ideation ( $n = 397$ ). The circles represent the variables (BD: Body dissatisfaction; BEB; binge-eating behaviors; CB: Compensatory behavior; CAS: Cognitive anxiety symptoms; CDS: Cognitive depressive symptoms; FA: Family agreement; FS: Family support; PDS: Physical depressive symptoms; PAS: Physical anxiety symptoms; SI: Suicidal ideation). The lines represent the edges, which in turn represent the relationships between the symptoms (blue lines correspond to positive associations and red lines to negative associations). The thickness of the edges represents the magnitude of the association between nodes.

## 2.3 | Statistical analysis

### 2.3.1 | Network estimation

We estimated networks using Graphical Gaussian Model (GGM) (Epskamp et al., 2017). It considers the whole data set to establish possible relationships between nodes simultaneously, controlling for all other nodes (Bhushan et al., 2019). Networks comprise nodes represented by circles, and lines reflecting connections between nodes (i.e. thicker lines represent stronger connections between nodes). We eliminated spurious and small between-nodes associations using the graphical LASSO (Least Absolute Shrinkage and Selection Operator; Friedman et al., 2008) using the R package qgraph (Epskamp et al., 2012, 2017), included in the R software.

### 2.3.2 | Node centrality

We assessed the node's capability to trigger the development of other nodes (Cramer & Borsboom, 2015) by computing centrality indices, which provide information about the importance of nodes in a network (Fried et al., 2017). As suggested by Bringmann et al. (2019), we only used the strength centrality index, which quantifies the direct connection among nodes (Mullarkey et al., 2018). We used the R qgraph package. To correct the influence of negative relationships among nodes, we computed the expected influence analysis (Heeren et al., 2018; Robinaugh et al., 2016).

### 2.3.3 | Network stability and accuracy

We computed the stability of the strength centrality index using the correlation stability coefficient (CS-coefficient). This quantifies the maximum proportion of cases that can be dropped to retain a

correlation with the original centrality of higher than (by default).7, with 95% certainty. Values should be minimum .25 for the centrality to be stable, and preferably  $>.5$ . Additionally, we computed the accuracy of the edges by a non-parametric bootstrap method to calculate 95% confidence intervals of the edge weights. This addresses if the edges do significantly differ from one another, using the R package bootnet (Epskamp et al., 2017). Finally, we quantified the contribution of a factor within a multiple regression model (relative importance analysis) using the relaimpo package (Grömping, 2006).

## 3 | RESULTS

### 3.1 | Descriptive statistics

Table S1 shows demographic and clinical characteristics of the sample. Eight point 3% of individuals presented symptoms of bulimia nervosa, and 4.3% displayed symptoms of binge eating. 16% had high suicidal ideation, and 1.3% and 16.6% presented severe depressive and anxiety symptoms respectively. Tables S2 and S3 show the scores of questionnaires and variable correlations.

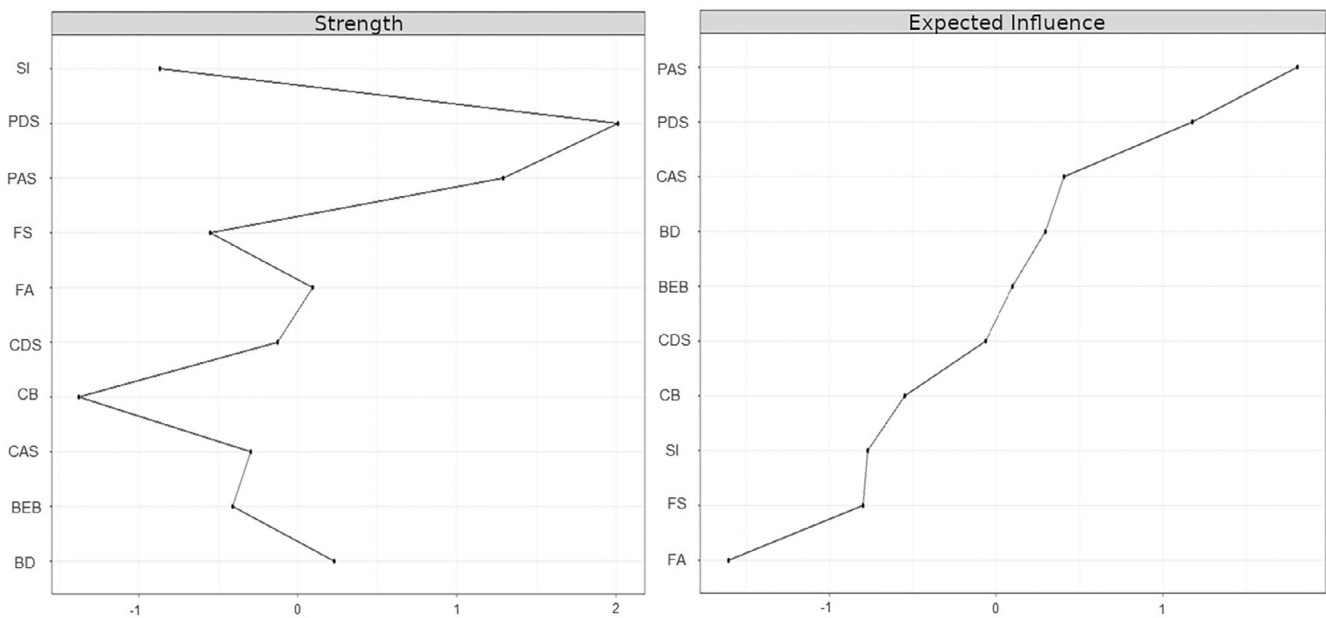
### 3.2 | Network analysis

#### 3.2.1 | Estimated network

As shown in Figure 1, the strongest within-domain interconnectedness, represented by the denser lines, was observed for anxiety nodes, followed by the link between perceived family functioning variables, the connections between binge behavior and body dissatisfaction, between depression nodes, and finally, between body dissatisfaction and compensatory behaviors. The strongest between-domains links were observed between physical anxiety and physical depression nodes, followed by the connections between body dissatisfaction and physical depression nodes, and between physical anxiety and cognitive depression nodes. Finally, SI was strongly connected to physical and cognitive depression symptoms. Figure S1 shows differences between edges that were non-zero in the estimated network.

#### 3.2.2 | Strength centrality index and expected influence

The strongest nodes were physical anxiety and physical depressive symptoms, followed by body dissatisfaction, family agreement, and cognitive depressive symptoms (Figure 2a). The expected influence analysis (Figure 2b) revealed that the nodes with higher values were physical anxiety symptoms and physical depressive symptoms, followed by cognitive anxiety symptoms and body dissatisfaction.



**FIGURE 2** (a) Strength centrality index of each node. (b) Expected influence of each node ( $n = 397$ ). BD: Body dissatisfaction; BEB; Binge-eating behaviors; CB: Compensatory Behavior; CAS: Cognitive anxiety symptoms; CDS: Cognitive depressive symptoms; FA: Family agreement; FS: Family support; PAS: Physical anxiety symptoms; PDS: Physical depressive symptoms; SI: Suicidal ideation.

### 3.2.3 | Network stability and accuracy

The correlation stability coefficient was .673, making our results interpretable (Figure S2a). The edge-weight accuracy indicated that most edges are not meaningfully different from each other because their confidence intervals overlap (Figure S2b).

### 3.2.4 | Relative importance

The strongest connection was between physical anxiety symptoms→cognitive anxiety symptoms, which significantly differs from the rest of the interactions. Moreover, connections between family agreement→family support also differ from most of the other connections (Figure S3).

## 4 | DISCUSSION

Our network analysis of ED symptoms, AS and DS, SI, and FF in university students yielded that the central nodes were PAS, CDS, and PDS. These nodes were connected to ED nodes, particularly with binge behavior. This supports that depressive and anxiety symptoms are comorbid conditions of EDs (Smith et al., 2018a; Solmi et al., 2018), and SI (Brown et al., 2018; Conti et al., 2017).

The links observed between both depression nodes with body dissatisfaction and between cognitive depression and binge behavior partially fit with Godfrey et al. (2019), who additionally found connections between physical depression symptoms and compensatory behaviors in adults. We observed strong connections between depression symptoms

and SI, similar to a prior network study with adolescents (Gijzen et al., 2021). In our network, SI was linked to compensatory behaviors but not to binge behavior, as reported by Wang et al. (2020), who observed that restrictive eating was the most significant ED symptom associated with SI, while other ED symptoms were minimally associated with suicidality in adolescents. Moreover, physical anxiety was the most central node, in accordance with prior longitudinal research with adolescents (Puccio et al., 2017), and also with a network study reporting strong interconnectedness between anxiety and ED symptoms in patients with EDs (Forrest et al., 2019). Anxiety symptoms were also associated with binge behavior, and minimally associated with compensatory behavior, which fits with literature (Lim et al., 2021; Martín et al., 2019). Thus, our findings highlight the role of physical anxiety and cognitive depressive symptoms as factors involved in the association between ED symptoms and SI, as observed by Gómez del Barrio et al. (2022).

Lastly, FF was not central in the network, but we found relevant negative associations between EDs nodes and perceived family agreement, thus suggesting this variable's potential protective role. Moreover, in line with prior research (Chang et al., 2017; Frey & Cerel, 2013), we found negative associations between FS and SI. Unexpectedly, we observed a positive connection between FS and compensatory behavior. Further research is needed to better understand these preliminary findings, where approaches such as the integrated relational model proposed by Erriu et al. (2020), could provide new insights into these associations.

### 4.1 | Limitations

Our cross-sectional design does not allow for conclusions about causality. Additionally, we used self-report measures, and because of the

great number of items, we collapsed them into single nodes. This could have created a source of bias in our results. Family functioning was assessed through the perception of the participants rather than through perceptions of their own families. Moreover, individuals with higher levels of symptomatology could have perceived their family functioning more negatively. The high centrality in our analysis might be probably due to the moderate-high correlation between the anxiety and depression items. Furthermore, we used a non-clinical convenience sample, observing a low incidence of disorders, hindering transference of our results to clinical samples. Finally, we did not address variables reported as relevant suicidal factors beyond depression, which could have help explain the prevalence of SI in our sample.

## 4.2 | Implications

Our findings that AS, DS, and FF are associated with SI and ED symptoms in university students highlight them as potential targets to develop evidence-based preventive strategies to avoid the transition to clinical manifestations in this population. A better understanding of the specific role of family variables in these complex associations could enhance the effectiveness of preventive interventions.

### AUTHOR CONTRIBUTIONS

**Camila Murga:** Formal analysis; investigation; writing – original draft.  
**Ruth Cabezas:** Formal analysis; investigation; writing – original draft.  
**Carolina Mora:** Conceptualization; data curation; investigation.  
**Susana Campos:** Conceptualization; formal analysis; writing – original draft.  
**Daniel Núñez:** Conceptualization; formal analysis; methodology; project administration; writing – review and editing.

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### CONFLICT OF INTEREST

The authors have no conflict to declare.

### DATA AVAILABILITY STATEMENT

N/A

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## SUPPORTING INFORMATION

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