Mediational Links for the Severity of Anorexia and Bulimia a Path Analysis Study

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Research Article

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Abstract

Background: to date there is empirical evidence on the associations between anorexia and bulimia nervosa with psychopathological constructs (anxiety, depression, perfectionism, emotional dysregulation) and sociodemographic characteristics (gender and place of origin). However, there are no studies that analyze the underlying mechanisms between these variables, which allow estimating the direct and indirect effects, including the possible mediational relationships in causal models of path analysis.

Method: the study had a sample of 918 Ecuadorian university students from three places of origin.

Results: The causal path analysis model indicates a significant and positive association between the variables depending on the place of origin of the participants. Likewise, the model obtained an adequate goodness of fit and good predictive capacity.

Conclusions: The data suggest that the model of underlying relationships between the study variables for the risk of ED, anorexia nervosa and bulimia nervosa, is different depending on the place of origin. It is indicated for future studies to estimate the criterion in the clinical population and with repetitive measures over time. We believe that the study will provide a starting point in the design, implementation and evaluation of prevention programs for eating disorders at the primary action levels.

Plain English Summary

It is known that there are associations between anorexia and bulimia nervosa with: anxiety, depression, perfectionism, emotional dysregulation, gender and place of origin. However, there is no information on these associations using trail analysis models, which allow estimating the direct and indirect effects. Therefore, this study had a sample of 918 Ecuadorian university students from three places of origin. The results indicate that the model has a good predictive capacity and is different according to the place of origin of the participants. Future studies are encouraged to evaluate the model in a clinical population and with repetitive measures over time. We believe that the study will provide support in prevention programs for eating disorders.

Introduction

Anorexia nervosa (AN) is classified within eating disorders (ED) and it is defined by the restriction of food intake, producing a marked decrease in weight (which reaches values below the minimum expected by sex and age), and it is accompanied by a permanent fear of increasing weight and persistent concerns about body image (American Psychiatric Association, APA, 2013). Bulimia nervosa (BN) is also included within the eating disorders group, and characterized by repeated episodes of excessive intake that occur in a short period of time (binges) and are accompanied by control behaviors weight (usually vomiting, fasting, intense exercise, use of laxatives and/or diuretics). BN shares the same dysfunctional concerns that AN about image and weight (recurrent feelings of body dissatisfaction and fear of gaining weight appear), but BN patients usually present weight into the normal range (APA, 2013). Both AN and BN disorders profiles show significant psychosocial impairment and severe medical complications (both physical and psychological), which can lead to an increased risk of suicide (Arcelus et al., 2011; Jenkins et al., 2011).

The prevalence of eating disorders varies depending on the geographic areas. In Europe, the rates obtained in cross-sectional studies for AN are between 1% and 4%, while for BN are into the range 1–2% (Keski-Rahkonen & Mustelin, 2016). In North America, the presence of AN is identified in the general population between 1% and 4.2% (APA, 2006) and between 0.5% and 1.0% for BN (NICE, 2004). In South America, epidemiological data is more imprecise, largely as a consequence of empirical studies (Mérida-Pérez & López-Hartmann, 2013): studies carried out in Argentina have published incidences between 2 and 8% for AN and BN; in Colombia around 2% (Colombo, 2006); and in Bolivia around 2.6% for AN and 4.7% for BN (Freudental, 2000). However, it should be clarified that many of the published studies are carried out in high-risk populations formed mainly by young women, which could be overestimating the real prevalence in the general population.

Anxiety problems are frequently comorbid with ED (Brytek-Matera, 2008; Solano & Cano, 2012; Swinbourne et al., 2012). Bulik (2002) noted that women with AN usually present anxiety symptoms related to the body weight and also to food behaviors. One of the anxiety disorders with the highest concurrence with AN is generalized anxiety disorder (Godier & Park, 2015; Woodside & Staab, 2006; Godart et al., 2003; Bulik, 2002). Furthermore, it has been observed that anxiety is not only a concurrent-comorbid state with eating disorders (Egan et al., 2013; Becker, DeViva & Zayfert, 2004), but also a mediating link with the high perfectionism trait that usually characterizes AN and BN patients (Egan et al., 2013; Rivière & Douilliez, 2017). For example, the Fairburn, Cooper & Shafran (2003) model indicates that perfectionism is a maintenance mechanism of eating disorders, which, modulated by anxiety levels, acts as a risk factor for an overestimation of diet as a determining factor of body composition and weight. On the other hand, empirical research focused on the psychological factors involved in the factors related with the progression and maintenance of eating disorders have also point to the important role of anxiety, which seem achieve a relevant role in the prevention and treatment programs (Rivière & Douilliez, 2017). In population-based samples, Montenegro, Blanco, Almengor & Pereira (2009) have observed the presence of a positive correlation between high levels of anxiety and greater severity of the eating disorders (concretely, in university students from Costa Rica). Other research carried out with Mexican university students found that anxiety components are crucial for the onset and the course of AN, but not for BN (within the BN condition, the contribution of anxiety is interacting with sex and with age of menarche) (Pineda-García et al., 2014). Finally, Unikel et al. (2010) observed that the presence and the way in which the risk factors for eating disorders (including anxiety) largely depend on the geographical areas.

Comorbidity studies in the eating disorders area have also identified the important role of mood symptoms for the presence and progression of both AN and BN (Hudson et al., 2007; Kaye et al., 2004), mainly depression (Tseng & Hu, 2012; Fischer et al., 2008), but also negative emotional states (Engel et al., 2005; Waller et al., 2003; Allen et al., 1998; Stice et al., al., 1996). In particular, it has been documented that AN and BN patients show high levels of depression compared with control samples without ED symptoms (Pyle et al., 1981; Bora & Köse, 2016; Franko et al., 2018; Hudson et al., 1987; Johnson & Larson, 1982; Kaye et al., 1986; Keck et al., 1990; Laessle et al., 1987; Lavender et al., 2015).

A current research is focused on the analysis of the emotional regulation capacities in patients with eating disorder (Claudat & Lavender, 2018; Donahue et al., 2018; Mallorquí-Bagué et al., 2017; Pisetsky et al., 2017). This construct refers to the ability of people to identify and manage emotions appropriately, which implies having the necessary skills to relate emotions, cognition and behavior (Lavender et al., 2015). Functional emotional regulation involves being able to express emotions appropriately, regulating emotions and feelings appropriately to the contextual demands, having adequate coping skills, and being able to generate positive

emotions. It has been observed that different forms and levels of emotional dysregulation predict the onset and the progression of several psychopathological conditions (Aldao et al., 2010), including eating disorders (Aldao et al., 2010; Gratz & Roemer, 2004; Haynos & Fruzzetti, 2011; Lavender et al., 2015; Mennin & Fresco, 2009; Selby, Anestis, & Joiner, 2008). Concretely, patients with AN show difficulty both in recognition and regulation of their emotions (Harrison et al., 2009), and in some cases these correlates are also related with the presence of alexithymia (Westwood et al., 2017). On the other hand, patients with BN have showed compulsive episodes associated with difficulties in controlling impulsivity, which are also worse in the presence of positive and/or negative emotional states (Bongers et al., 2013; Leehr et al., 2015). BN patients have also showed that negative mood states related with impairing emotional regulation frequently precede binges (Gianini et al., 2015; Nicholls et al., 2016).

Objectives

In summary, empirical studies evidence the relationships between AN and BN with psychopathological constructs such as anxiety, depression, perfectionism and emotional regulation. However, to our knowledge no studies have analyzed the underlying mechanisms/processes of these variables through models testing direct and indirect effects.

The present research aims to explore the associations between perfectionism, emotional dysregulation, anxiety, depression, sex and geographical origin with the AN and BN severity, through path analysis implemented with structural equations models.

Method

Participants

The sample included $n=918$ university students from Ecuador, resident in three cities of the country: Cuenca, Quito and Guayaquil. The participants were contacted through the institutional e-mail, and they were informed regarding the voluntary collaboration in the study.

The sample included three groups: $n=302$ participants from the Catholic University of Cuenca; $n=306$ participants from the Pontifical Catholic University of Ecuador in Quito, and $n=310$ participants from the University of Guayaquil. The mean age was 21.34 years ($SD = 2.74$).

Instruments

Risk Factors Associated with Eating Disorders Scale (Gómez-Peresmitré & Ávila, 1998). This questionnaire explores the eating behavior styles and it screens for the high risk of eating disorders. Items are coded in a 5-points Likert-scale (from 1 "never" to 5 "always"). The questionnaire includes seven dimensions: bulimia nervosa, anorexia nervosa, normal eating behavior, external food control attribution, psychological compensation, chronic and restrictive diet, and attribution factor. The sum of the scores within each subscale is interpreted as the severity on the correspondent dimension, as well as the potential risk of suffering of an eating disorder. The bulimia nervosa and the anorexia nervosa scores were used in this study, as measures of the symptom levels of each condition. In our sample, the internal consistency was very good, with values of Cronbach-alpha $\alpha=0.90$ for BN and $\alpha=0.84$ for AN.

Goldberg Anxiety and Depression Scale (GADS) (Goldberg et al., 1988). Self-report screen tool for the severity of the anxiety and depression level. It contains 18 items coded with a binary-response option (no-yes), grouped in two scales. The questionnaire has obtained adequate psychometrical evidence (Goldberg et al., 1988), also in the Ecuadorian adaptation (Reivan-Ortiz et al., 2019). In the sample of the study, internal consistency was $\alpha=0.74$ for anxiety and $\alpha=0.76$ for depression.

Multidimensional Perfectionism Scale MPS (Frost et al., 1990). This questionnaire assesses perfectionism as a multidimensional construct, through 35 items coded with 5-point Likert-scale (from strongly disagree to strongly agree). Items are grouped into six factors (personal standards, concern over mistakes, doubts about actions, parental expectations, parental criticism, and organization), and a total score is also obtained as the sum of all the items. Studies have provided evidence regarding its psychometric properties (Frost et al., 1990). In this work, the global scale obtained an excellent consistency, $\alpha=.89$.

Difficulties in Emotion Regulation Scale DERS (Gratz & Roemer, 2004). Self-report questionnaire aimed to assess difficulties in the emotional regulation. It includes 36 items coded in a 5-point Likert-scale (from never or almost never to always or almost always), grouped in five primary factors: non-acceptance of emotional responses, difficulty engaging in goal-directed behavior, impulse control difficulties, lack of emotional awareness, limited access to emotion regulation strategies, and lack of emotional clarity. A total score is also available as the sum of all subscales. The Ecuadorian adaptation of the tool achieved adequate psychometric properties (Reivan-Ortiz et al., 2020). In this work, internal consistency for the global score was excellent, $\alpha=0.91$.

Procedure

The study obtained the approval of the Ethic Committee of the Catholic University of Ecuador, and it was carried out according to the guiding statements in the Declaration of Helsinki for health-medical research in humans.

All the participants provided signed consent, and were informed of the objectives of the research. It was guaranteed that all the data would be managed with absolute confidentiality, according to the APA's Ethical Principles of Psychologists and Code of Conduct (APA, 2002, 2008). Participants get no monetary compensation for their collaboration.

Statistical analysis

Statistical analysis was carried out with Stata15 for windows. Path analysis was implemented through structural equation modeling (SEM). This procedure is an extension of multiple regressions with the aim to model direct and indirect (mediational) effects (Kline, 2005). The procedure can be used for exploratory and confirmatory analyses, and therefore it is useful for testing and developing theories (MacCallum & Austin, 2000). In this work, SEM was conducted with the maximum likelihood estimation parameter, defining a multi-group model to assess the invariance of the structural coefficients based on the geographical origin of the sub-samples. Goodness-of-fit was tested with the usual indexes: chi-square test (X^2), Root Mean Square Error of Approximation (RMSEA), Bentler's Comparative Fit Index (CFI), Tucker-Lewis Index (TLI) and Standardized Root Mean Square Residual (SRMR). It was considered adequate fitting for (Barret, 2007): non-significant result in the X^2 test, $RMSEA<0.08$, $TLI>0.90$, $CFI>0.90$ and $SRMR<0.10$. The global predictive capacity for the fitted model was valued with the coefficient of determination (CD).

Results

Characteristics of the sample

Table 1 displays the sociodemographic description of the sample, and the comparison between the groups (Cuenca, Quito and Guayaquil). The groups presented differences for sex (lower proportion of women in Quito), employment status (higher proportion of employed participants in Quito), education levels (higher proportion of participants within initial cycles in Cuenca) and age (younger participants in Cuenca). No differences by marital status emerged.

Path Analysis

SEM achieved adequate fitting: $\chi^2=6.33$ ($p=.097$), RMSEA=0.06, CFI=0.997, TLI=0.945, and SRMR=0.015. Global predictive capacity was around 30% (CD =0.284). The global invariance test showed significant results, ($\chi^2=65.99$, $p<.001$), suggesting that the underlying processes are different depending on the geographic area. Figure 1 shows the path-diagram with the standardized coefficients, stratified by the city. Continuous lines represent significant coefficients ($p>0.05$), while dash lines represent non-significant coefficients ($p>0.05$). Table S1 (supplementary material) contains the complete results for the model.

For Cuenca (first path-diagram of Figure 1), it was observed that AN severity was higher for subjects with higher scores in perfectionism and emotional dysregulation (these two effects constituted direct effects). On the other hand, the BN severity was directly related to higher levels of perfectionism and emotional dysregulation, and also to higher depressive symptoms level. For BN, an indirect relationship was obtained through the mediation role of the depressive levels: the higher values in depression are reported by women and by patients with higher scores in perfectionism and emotional dysregulation, and higher depressive symptoms levels increased BN levels (that is, depression is a mediating variable in the path between sex, perfectionism, and emotional dysregulation with BN). Other indirect effect for BN was obtained through the mediation role of emotional dysregulation: higher scores in emotional dysregulation were related to higher perfectionism levels (that is, emotional dysregulation is a mediating variable in the relationships of perfectionism with BN).

For Quito (second path-diagram of Figure 1), it was observed higher AN level among individuals with a higher perfectionism and depression scores (these associations constitute direct effects). BN severity was directly related to higher emotional dysregulation and depressive symptoms levels, as well as with male gender. For AN and BN, indirect effects were obtained through the mediation role of the depressive score: the higher values in depression were obtained for women and patients with higher perfectionism and emotional dysregulation, and higher depressive symptoms increased AN and BN levels (depression was a mediational variable in the path between sex, perfectionism and emotional dysregulation, with AN and BN). Other indirect effect was obtained, being emotional dysregulation a mediational variable: the higher values in emotional dysregulation were obtained for patients with higher perfectionism levels (emotional dysregulation is a mediational variable in the path between perfectionism with AN and BN).

For Guayaquil (third path-diagram of Figure 1), it was observed that AN severity was higher for female sex, and those with higher perfectionism and emotional dysregulation levels (these were direct effects). The BN severity was directly related to the male sex and higher emotional dysregulation levels. For AN and BN indirect effects also were found, through the mediational role of emotional dysregulation: higher values in emotional

dysregulation were obtained in patients with higher perfectionism scores (emotional dysregulation was a mediational variable in the path between perfectionism with AN and BN).

Discussion

The present study aimed to analyze the underlying mechanisms of AN and BN levels through path analysis, which measured the direct and indirect effects (mediational links) between emotional regulation, perfectionism, anxiety, depression, sex and geographical area (Cuenca, Quito and Guayaquil), in a large sample of Ecuadorian university students. The main results showed that the city obtained significant results in the invariance test, suggesting that the relationships patterns depended on the city.

The results regarding the differences in the structural coefficients depending on the region of origin are consistent with other investigations (Pineda-García et al., 2017; Pineda-García et al., 2014; Unikel et al., 2010), which implies that the etiological study of AN and BN must be carried out specifically according to the geographical areas (even within the same country).

The AN and BN levels were not directly influenced by the anxiety scores in the three cities, despite high anxiety was frequently related to the presence and severity in ED patients (Brytek-Matera, 2008), concretely among AN (Bulik, 2002; Godier & Park, 2015; Woodside & Staab, 2006; Godart et al., 2003). It should be noted that in two cities (Cuenca and Quito) women showed higher scores in the anxiety measure, which can also suggest that female sex could show higher concerns about food without being necessarily concerns about weight (Bulik, 2002).

On the other hand, this study evidenced that depression was associated with higher AN and BN levels in Quito, and with higher BN levels in Cuenca. This is consistent with previous results (Tseng & Hu, 2012; Fischer et al., 2008), which suggest that AN and BN are characterized by negative emotion states, such as depressive symptoms and general/specific negative affective states (Engel et al., 2005; Waller et al., 2003; Allen, Scannell & Turner, 1998; Stice et al., 1996).

Emotional dysregulation was associated with higher AN and BN levels in Cuenca and Guayaquil, and only with BN levels in Quito. This result reinforces previous studies which indicate the central role of this construct for eating disorders (Gratz & Roemer, 2004; Haynos & Fruzzetti, 2011; Wildes & Marcus, 2011), particularly for the onset and progression of AN and BN (Lavender et al., 2015). The observation of the predictive contribution of perfectionism on the emotional dysregulation levels, and the contribution of this phenotype on the AN and BN levels also reinforce the relevance of perfectionism as a central key within the eating disorders spectrum (Bruch, 1978; Franco Paredes et al., 2005; Milos et al., 2004; Moor et al., 2004; Moreno, 2018; Scappatura et al., 2017; Badenes-Sastre et al., 2016; Pratt et al., 2001; Rodríguez et al., 2016; Rutzstein et al., 2014; Rutzstein et al., 2013; Vitousek & Manke, 1994). In our study, perfectionism directly contribute on the AN scores, and in the Cuenca city it also achieved an impact on the BN levels. Regarding the indirect effects, the contribution of perfectionism on the AN level was mediated by the emotional dysregulation and the depression levels within participants in Quito, and only by emotional dysregulation among participants in Cuenca and Guayaquil. On the other hand, the indirect effect of perfectionism on the BN levels was mediated by emotional dysregulation and depression in Cuenca and Quito, while it was only mediated by emotional dysregulation in Guayaquil. This result also

reinforces evidences obtained in previous studies, which suggest that perfectionism is a process implied in the onset and maintenance of the eating disorders (Rivière & Douilliez, 2017; Fairburn et al., 2003).

This study should be interpreted according to a set of limitations. First, the sample included difference proportion of men and women, which should be taken into account when generalizing the results. On the other hand, screening tools were used for assessing the presence of AN and BN symptom levels, which did not allow to assess the clinical presence of the AN and BN disorders. Finally, cross-sectional data was analyzed, which limited the capacity to assess the longitudinal processes between the variables.

Two main strengths should be highlighted: the sample composition (size and precedence), and the statistical approach. The sample included university students, which represent a group with high vulnerability for the onset and progression of eating disorders (cultural and social stereotypes about the figure and body image have high impact on this group). In addition, the large sample size and the inclusion of participants from the biggest cities in Ecuador provides of high external validity to the study. Regarding path analysis, there are several advantages for this method in the psychological research: it allows examine multiple direct and indirect effects (including mediational relationships), and it provides a very useful graphical representation (it helps to make dependencies between variables visible and clear).

The raising prevalence of eating disorders among university students makes necessary empirical evidence regarding the underlying mechanisms explaining the onset and progression of these complex clinical processes. To the best of our knowledge, this is the first study exploring the role of sex, age, perfectionism, emotional regulation, anxiety and depression in the AN and BN levels. The evidence that the relationships-paths are different depending on the geographic areas should be taken into account for the development of prevention and treatment plans. Currently, many intervention systems used in Ecuador were initially developed for patients living in other countries (mainly United States and/or European countries), and therefore there is no evidence regarding the efficiency for patients with other clinical profiles. Our results should contribute to the development of new prevention and treatment approaches, focused on the specific needs of individuals in South America.

Conclusions

The mechanisms that influence the risk of suffering from the disorder of anorexia and bulimia nervosa are mediated by the psychopathological severity of anxiety, emotional regulation, depression and perfectionism, through a different causal model of underlying relationships in each place of origin. The female gender is a biological characteristic that prevails the risk of the disorder in the three places evaluated.

Abbreviations

AN: Anorexia nervosa; BN: Bulimia nervosa; ED: Eating disorder; RMSEA: Root Mean Square Error of Approximation; CFI: Comparative Fit Index; TLI: Tucker-Lewis Index; SRMR: Standardized Root Mean-Square.

Declarations

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Authors 'contributions

GGRO was responsible for the study design, data collection, and descriptive data analysis. RGP was responsible for the literature review and performed the path analysis. PEOR contributed to the analysis and discussion of the findings. The authors read and approved the final manuscript.

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Availability of data and materials

Please contact GGRO for data request.

Ethical approval and consent to participate

The research project was approved by the Research Ethics Committee of the Catholic University of Cuenca (Po-INV-R00765: reference 2020). All participants in the Quito, Guayaquil and Cuenca University groups received verbal and written information about the research project and signed a consent form. They were also informed that they could withdraw from the study at any time. The data was treated confidentially and anonymized.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1
Description of the sample

		Cuenca <i>n</i> = 302		Quito <i>n</i> = 306		Guayaquil <i>n</i> = 310				
		<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	χ^2	<i>df</i>	<i>p</i>
Sex	Women	185	61.3	164	53.6	196	63.2	6.59	2	< .001
	Men	117	38.7	142	46.4	114	36.8			
Civil status	Single	279	92.4	276	90.2	290	93.5	6.07	6	.416
	Married	16	5.3	24	7.8	18	5.8			
	Divorced	6	2.0	4	1.3	2	0.6			
	Widow	1	0.3	2	0.7	0	0			
Employment	Employed	58	19.2	78	25.5	37	11.9	18.54	2	< .001
	Unemployed	244	80.8	228	74.5	273	88.1			
Education	1st semester	148	49.0	1	0.3	0	0	883.55	16	< .001
	2nd semester	65	21.5	6	2.0	28	9.0			
	3th semester	89	29.5	42	13.7	41	13.2			
	4th semester	0	0	85	27.8	101	32.6			
	5th semester	0	0	75	24.5	5	1.6			
	6th semester	0	0	49	16.0	21	6.8			
	7th semester	0	0	43	14.1	17	5.5			
	8th semester	0	0	0	0	0	0			
	9th semester	0	0	3	1.0	3	1.0			
	10th semester	0	0	2	0.7	94	30.3			
		Mean	SD	Mean	SD	Mean	SD	<i>F</i>	<i>df</i>	<i>p</i>
Age (years)		20.27	2.53	21.99	2.49	21.74	2.88	37.423	2/916	< .001
Note. Bold: significant difference (.05 level). df Degrees of freedom, SD Standard deviation.										

Figures

Figure 1

Path-diagram obtained in the SEM: standardized coefficients Note. Continuous lines: significant coefficients ($p \leq .05$). Dash lines: non-significant coefficients.

Supplementary Files

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