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Restrictive Eating Behaviors are a Non-Weight-Based Marker of Severity in Anorexia Nervosa

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Abstract

Objective—The purpose of this study was to compare the type and frequency of restrictive eating behaviors across the two subtypes of anorexia nervosa (AN; restricting [ANr] and binge eating/purging [ANbp]) using ecological momentary assessment (EMA) and to determine whether subtype differences in restrictive eating behaviors were attributable to severity of the disorder or the frequency of binge eating.

Method—Participants ($N = 118$) were women at least 18 years of age with full ($n = 59$) or subthreshold ($n = 59$) AN who participated in a two week (EMA) protocol.

Results—General estimating equations revealed that individuals with ANbp generally reported more frequent restrictive eating behaviors than individuals with ANr. These differences were mostly accounted for by greater severity of eating psychopathology, indicating that the presence and frequency of restrictive eating behaviors in AN may be non-weight-based markers of severity. Binge eating frequency did not account for these findings.

Discussion—The present findings are especially interesting in light of the weight-based severity rating in the DSM-5.

Keywords

Anorexia nervosa; subtypes; dietary restriction; severity

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Low body weight accompanied by cognitive symptoms involving distortions of body image and weight status are perhaps the most salient features of anorexia nervosa (AN); however, across individuals with the disorder, the presentation of AN is not homogeneous and may be characterized by various disturbances in eating behavior. Within the nosology of the Diagnostic and Statistical Manual of Mental Disorders (DSM) IV (1), as well as the DSM-5 (2), this heterogeneity in AN is accounted for diagnostically via the binge eating/purging (ANbp) versus restricting (ANr) subtypes that distinguish between individuals who do and do not regularly engage in binge eating and/or purging behaviors.

Although much of the existing evidence supports the AN subtype distinction, a number of findings question the validity of these subtypes (see 3). Empirical evidence that supports this distinction includes findings regarding subtype differences in comorbidity, treatment response, and outcome. For instance, research suggests that individuals with ANbp present with greater co-occurring psychopathology than individuals with ANr (4). In particular, compared to those with ANr, individuals with ANbp have been found to display greater rates of substance use disorders (5) and affective and personality disorders (6), as well as various personality features (7), greater risk of suicide attempts (8), reduced treatment response to certain psychotherapies (e.g., 9), and a poorer prognosis (10, 11).

On the other hand, longitudinal research on the AN subtypes has generally failed to support the stability of this distinction. For instance, researchers have documented high rates of "diagnostic crossover" between the two subtypes (e.g., 12), such as occurs when an individual originally diagnosed with ANr subsequently develops regular purging behaviors and consequently meets criteria for the ANbp subtype. Specifically, 55% of those who entered a longitudinal study with a diagnosis of ANr crossed over to a diagnosis of ANbp at some point during the 7-year follow-up period. Conversely, 43.8% of individuals entering the study with ANbp followed the opposite trajectory, going from ANbp to ANr at some point. In another longitudinal study examining diagnostic crossover, Fichter and Quadflieg (13) found rates of crossover from ANr at baseline to ANbp at 2, 6, and 12 years of 19.2%, 11.5%, and 3.8%, respectively. In the reverse direction, they found crossover rates from ANbp at baseline to ANr at 2, 6, and 12 years of 4.8%, 9.5%, and 3.2%, respectively. Although the rates of crossover found by Eddy and colleagues (12) appear substantially higher, it is important to note they reported cumulative crossover rates (i.e., whether crossover had occurred at any point during the 7-year interval), whereas Fichter and Quadflieg (13) presented cross-sectional rates of crossover (i.e., the percent who were presently crossed-over at the three follow-up assessments). Importantly, however, both studies suggest that the AN subtypes are not particularly stable and that movement from ANr to ANbp is more likely than the reverse.

Ultimately, diagnostic crossover between the AN subtypes requires the development or cessation of regular binge eating and/or purging while continuing to exhibit the other cognitive, physical, and physiological features of AN. At the heart of the distinction between the subtypes is what the language of the diagnostic subtype labels seem to imply: that one presentation primarily engages in restrictive behaviors (i.e., engaging in behaviors such as skipping meals and fasting, eating very small amounts of foods, and eliminating or limiting specific foods, food types, or nutrients from one's diet for the purposes of weight

maintenance or reduction), whereas the other presentation regularly engages in binge eating and/or purging behaviors. However, given that maintaining a low body weight inherently requires individuals with AN to restrict their dietary intake to a point below their energy intake requirements, it remains unclear whether the subtypes differ with regard to restrictive eating behaviors as the subtype labels seem to imply.

Further, it is possible that many of the AN subtype differences in comorbidity and prognosis are attributable to the presence versus absence of binge eating and/or purging behaviors specifically. Researchers have speculated about the nature and mechanisms underlying the differences found between subtypes. For instance, some have posited that ANbp may be a more advanced form of the disorder than ANr in terms of longitudinal course (14, 15), which would implicate the presence of binge eating and purging behaviors as a marker of severity or duration. Others have proposed differences in the personality features that characterize the two subtypes, such that those with ANbp display greater impulsivity and sensation seeking than those with ANr (see 16 for a review). Still others might note that the differences found between subtypes are logical (e.g., individuals who engage in more eating disorder [ED] behaviors will have poorer outcomes; individuals who binge eat must restrict more in order to remain underweight, etc.).

The primary purpose of this exploratory study was to examine the clinical phenomena of restrictive eating behaviors across the two AN subtypes with data collected in a momentary, naturalistic fashion using ecological momentary assessment (EMA). The use of data collected via EMA allowed for assessments of various restrictive eating behaviors in AN when they occurred in the natural environment, thus avoiding concerns regarding the accuracy of data based on long-term retrospective recall of such behaviors. An additional use of EMA in this context was to examine possible explanations for any differences found in the frequency of restrictive eating behaviors across the subtypes. Two plausible explanations are that the subtypes differ in terms of overall level of ED psychopathology or that differences in the frequency of restrictive eating behaviors are driven by differences in the frequency of binge eating (i.e., consistent with the possibility of restrictive eating behaviors as compensatory to binge eating). Thus, the secondary purpose of this study was to determine whether any subtype differences in the frequency of restrictive eating behaviors are accounted for by: (1) simple subtype differences in overall baseline ED severity, or (2) the frequency of binge eating behavior in the natural environment. Importantly, the frequency of binge eating is not synonymous with the subtype distinction, because binge eating frequency can vary within and across subtypes. To date, the nature of restrictive eating behaviors within each of the AN subtypes, including possible subtype differences, has not been explored. Understanding any such differences may improve conceptual models of the subtypes and guide associated treatment development efforts.

METHOD

Participants

Participants ($N = 118$) were women with full ($n = 59$) or sub-threshold ($n = 59$) AN who were at least 18 years old[a]. Full AN was defined as meeting all DSM-IV (1) criteria, and sub-threshold AN was defined as meeting all DSM-IV criteria for AN except one of the

following: (1) body mass index (BMI) of 17.6 to 18.5 kg/m^2, (2) no amenorrhea, or (3) no body image disturbance and intense fear of fatness. Minimal differences between individuals meeting full and subthreshold AN criteria were present (see 17). A total of 73 (61.9%) participants met criteria for ANr, while the remaining 45 (38.1%) met criteria for ANbp. To make this subtype distinction, the regular occurrence of binge eating and/or purging behavior was operationalized as binge eating and/or purging behavior occurring on average at least once per week over the previous 8 weeks. Participants were recruited through referrals from treatment providers and advertisements in the community, treatment centers, and college campuses in three locations in the Midwestern U.S. (Fargo, Minneapolis, and Chicago). Demographics and symptom severity information can be found in Table 1.

Measures

Baseline Interviews—The Structured Clinical Interview for DSM-IV Axis I Disorders, Patient Edition (SCID-I/P; 18) was used to establish the AN diagnosis. A random sample of 30 of these interviews were rated by an independent assessor for reliability of the AN diagnosis (full versus subthreshold), yielding a kappa coefficient of .929.

The Eating Disorder Examination (EDE; 19) is a semi-structured interview that provides a global score of eating psychopathology and four subscales: restraint, eating concern, shape concern, and weight concern. The EDE also assesses the frequency of various ED behaviors including binge eating and purging during the previous 3 months. In the present study, it was used to determine AN subtype. A subset of 31 EDE interviews was rated by an independent assessor for reliability, yielding intraclass correlation coefficients ranging from .894 to .997 for the subscale scores.

EMA Measures[b]—As part of the EMA protocol in this study (described below), participants were asked to report various ED behaviors. Among other behaviors, participants were asked to report binge eating episodes, compensatory behaviors (e.g., self-induced vomiting), and restrictive eating behaviors (e.g., skipping a meal; limiting calories, carbohydrates, or fat grams; and eating as little as possible). In addition, at the end of each day, participants also indicated whether they had gone 8 or more waking hours without eating and whether they limited their intake that day to less than 1200 kilocalories.

Procedure

Individuals interested in participating were first screened for eligibility via telephone. Eligible individuals then attended an informational meeting about the study during which they provided written informed consent. Participants attended two assessment visits, during which they completed semi-structured interviews, self-report questionnaires, and medical stability screenings. If individuals were judged to be medically unstable (e.g., serious electrolyte abnormalities or vital sign instability) by the examining physician, they could not participate in the study until they were medically stable. During the first visit, participants

[a]An additional 3 individuals participated in the study, but they were excluded from all analyses because their compliance rate for random-signal reports in the EMA protocol was less than 50%.
[b]Other EMA measures in the protocol that are not reported on in this study were assessments of affective states, self-discrepancy, stressful events, and other eating disordered behaviors/rituals.

were instructed on how to use the palmtop computers for EMA recordings. They completed practice ratings over the next two days and then returned for their second assessment visit during which they received feedback regarding their compliance with EMA recordings and received further instruction, if necessary. Participants then began the two week EMA protocol. Participants were compensated with $100 per EMA week and received a $50 bonus if they responded to at least 80% of random signals.

The EMA protocol included three types of recordings: signal contingent, interval contingent, and event contingent (20). The palmtop computers alerted participants to complete signal contingent EMA recordings. These signals occurred six times per day, anchored around times spread throughout the waking hours of the day: 8:30 a.m., 11:10 a.m., 1:50 p.m., 4:30 p.m., 7:10 p.m., and 9:50 p.m. Interval contingent recordings were completed at the end of each day. Event contingent recordings were initiated by participants immediately following the occurrence of specific pre-identified behaviors including binge eating, self-induced vomiting, and certain restrictive eating behaviors. Participants also provided ratings for other experiences and behaviors not reported on in this study. This protocol was approved by Institutional Review Boards at all three data collection sites.

Statistical Analyses

First, general estimating equations (GEE; 21) with a negative binomial response function appropriate for count data were used to test for univariate associations between AN subtype and the frequencies of various restrictive eating behaviors. Second, the relationship between subtype and frequency of restrictive eating behaviors was tested with baseline Global EDE score and mean number of EMA binge eating episodes included as covariates to control for differences in severity of ED symptomatology between the subtypes. Comparisons of subtypes were made using the Wald χ^2 statistic, and odds ratios with 95% confidence intervals were computed to provide an index of effect size. Prior to analyses, the EDE Global score was recalculated to remove items that assess content identical or very similar to the restrictive eating behaviors that represented dependent variables in the analyses. Specifically, two items that assessed going eight hours without eating and trying to restrict overall food intake were removed. The modified EDE Global score was highly correlated with the original score ($r = .994$, $p < .001$). All independent variables in the multivariate analyses were grand-mean centered to reduce multicollinearity. Analyses were conducted using SPSS Version 19.

RESULTS

Table 1 displays comparisons of the AN subtypes on the Global Assessment of Functioning, EDE scales, and demographic features. With regard to the frequency of binge eating and self-induced vomiting in each of the subtypes during the two weeks of the EMA protocol, 76.7% of the individuals with ANr reported no instances of binge eating and 86.3% reported no instances of self-induced vomiting. Conversely, 73.3% of individuals with ANbp reported at least one instance of binge eating and 82.2% reported at least one instance of self-induced vomiting.

The results of the univariate GEEs indicate that individuals with ANbp reported skipping meals and going eight or more waking hours without eating more frequently than individuals with ANr (see Table 2). In addition, ANbp participants reported limiting their kilocalories and eating as little as possible at meals more often than individuals with ANr. The subtypes did not differ in terms of the frequency of eating fewer than 1200 kilocalories in a day or the percent of meals at which fat grams or carbohydrates were limited.

In order to test whether the differences in the frequency of restrictive eating behaviors between AN subtypes were either markers of severity or related to the frequency of binge eating episodes, the modified EDE global score and mean binge eating episodes/week were added as covariates to the GEEs along with the covariates of age and BMI. The findings generally failed to support unique variance in restrictive eating behaviors based on subtype differences. In the prediction of "going eight or more waking hours without eating," the only significant predictors were the modified Global EDE score (Wald $\chi^2(1) = 7.65$, $p = .006$) and BMI (Wald $\chi^2(1) = 5.53$, $p = .019$), such that higher BMI and higher modified Global EDE scores were associated with more frequent engagement in this behavior, whereas subtype (Wald $\chi^2(1) = 1.50$, $p = .220$), binge eating frequency (Wald $\chi^2(1) = 0.45$, $p = .503$), and age (Wald $\chi^2(1) = 0.58$, $p = .448$) were not significant. In the prediction of skipping meals, the modified EDE Global score was the only significant predictor (Wald $\chi^2(1) = 10.22$, $p = .001$) while subtype (Wald $\chi^2(1) = 3.10$, $p = .078$), binge eating frequency (Wald $\chi^2(1) = 1.70$, $p = .193$), BMI (Wald $\chi^2(1) = 0.39$, $p = .531$), and age (Wald $\chi^2(1) = 1.07$, $p = .301$) were not significant. Analysis of limiting calories at meals revealed a similar pattern: the modified Global EDE score was a significant predictor (Wald $\chi^2(1) = 29.48$, $p < .001$), but subtype (Wald $\chi^2(1) = 0.48$, $p = .490$) binge eating frequency (Wald $\chi^2(1) = 0.46$, $p = .499$), BMI (Wald $\chi^2(1) = 0.61$, $p = .433$), and age (Wald $\chi^2(1) = 0.18$, $p = .671$) were not. The pattern of results differed for eating as little as possible during meals. Subtype remained a significant predictor (Wald $\chi^2(1) = 4.02$, $p = .045$), with ANbp reporting this behavior more frequently than ANr. In addition, the modified Global EDE score was a significant predictor (Wald $\chi^2(1) = 40.52$, $p < .001$), but binge eating frequency (Wald $\chi^2(1) = 0.85$, $p = .357$), BMI (Wald $\chi^2(1) = 0.21$, $p = .644$), and age (Wald $\chi^2(1) = 0.01$, $p = .929$) were not.

DISCUSSION

The purpose of this study was to compare the subtypes of AN on the frequency of specific restrictive eating behaviors and to examine possible factors accounting for subtype differences. Results indicate that individuals with ANbp reported certain restrictive eating behaviors more frequently than individuals with ANr (i.e., going eight or more waking hours without eating, skipping meals, limiting kilocalories, and eating as little as possible at meals), but there were no differences between subtypes in the frequency of other restrictive eating behaviors (i.e., eating fewer than 1200 kilocalories per day and limiting fat grams or carbohydrates at meals). These differences could not be accounted for by binge eating frequency as binge eating was not a significant covariate of restrictive eating behaviors when included with subtype, overall severity of ED psychopathology, age, and BMI. Thus, the elevated frequency of restrictive behaviors in the ANbp subtype does not appear to be a simple compensatory reaction to binge eating. However, differences between the subtypes

were significantly accounted for by Global EDE severity. Overall ED psychopathology emerged as the only consistent and robust predictor of all four restrictive ED behaviors and diagnostic subtype offered little additional information.

These results suggest that the frequency of restrictive eating behaviors that were observed to be more common in ANbp than ANr may be non-weight-based markers of severity in women with AN. Consequently, the AN subtype distinction itself may serve as a marker of the severity of ED psychopathology. Indeed, individuals with ANbp not only reported engaging in four of the seven primary restrictive eating behaviors in this study more often than those with ANr, but they also engaged in more binge eating and purging, consistent with their subtype categorization, and were judged to be functioning more poorly. Importantly, the subtypes did not differ in BMI, and the findings remained after accounting for BMI.

These findings may even have implications for ED diagnoses in the DSM-5, particularly for the severity dimensions that has been included for each of the ED diagnoses (2). For AN, the severity dimension will be based on current BMI. Body weight is an indisputably critical marker of medical severity in AN and has been associated with risk of mortality (22). The results of this study further indicate that the AN subtypes may be a useful proxy for degree of ED psychopathology, providing information about severity as well as the current configuration of behavioral symptoms. Indeed, the frequency of these restrictive eating behaviors (and perhaps binge eating and purging as well) may represent a non-weight-based dimension of severity in AN independent of BMI.

Such conclusions are consistent with a number of studies that characterized the nature of the difference between ANr and ANbp using statistical techniques to identify symptom clusters. These studies have generally failed to distinguish the two subtypes (e.g., 23–25). For instance, Olatunji and colleagues (26) recently noted that, although individuals with ANbp consistently scored higher than those with ANr on a number of dimensions of eating pathology, the results of taxometric analyses did not support a categorical distinction of ANr and ANbp, but rather supported a dimensional relationship. The results from the current study may be taken to extend this conclusion to differences between subtypes in terms of the frequency of restrictive eating behaviors, which may serve as a proxy for severity.

This study has a number of strengths, including the measurement of restrictive eating behaviors using EMA and a relatively large sample of women with AN. It also has limitations. The EMA protocol required participants to initiate a report following any of the pre-specified behaviors. It is possible that participants did not report every instance of binge eating and restrictive eating and, as a result, some of the behaviors may have been omitted. However, the EMA protocol also provided participants with the opportunity to report previous behaviors that had not yet been recorded as part of the random signal assessments, thus capturing behavioral events not recorded when they occurred. A second limitation of this study is the unavailability of information pertaining to duration of illness. As a result, it was not possible to address the possibility that individuals with ANbp had been ill longer, leading to greater overall severity and providing more time for the development of various ED behaviors. However, age did not account for the findings. Third, some of the restrictive

eating behavior items measured via EMA may also have measured dietary restraint (i.e., *attempts* to limit the types or amount of food eaten) and may not correspond particularly well with actual caloric intake. The assessment of restrictive eating behaviors was accomplished via self-report. As a result, the data are subject to all of the typical limitations of self-reported data (e.g., subjective interpretation of items). However, some items (e.g., going eight waking hours without eating; skipping meals; eating less than 1200kcal in a day) are more objective measures of restrictive eating than others, and the findings were generally consistent across these items. In addition, not all aspects of restrictive eating were assessed (e.g., avoiding specific foods), leaving open the possibility that the subtypes may differ on other forms of restrictive eating behavior. Fourth, although it is an established cutoff commonly used in ED assessments, the use of 1200kcal to define restrictive eating is a dichotomization of caloric intake that may have reduced variability. Finally, these results should be interpreted in light of the possibility that participants altered their behavior in response to repeated measurements, a phenomena referred to as reactivity to measurement. However, existing evidence suggests little reactivity occurs in this type of EMA research (27).

It is unknown what mechanisms of ANbp contribute to the greater severity of overall ED psychopathology compared to individuals with ANr. Future research should aim to test whether a longer duration of illness underlies this difference, which would indicate that ANbp is a more longitudinally advanced form of ANr, as some have suggested (e.g., 14, 15), or whether the distinction is best accounted for by certain situational (e.g., interpersonal distress) or dispositional (e.g., personality) factors that result in more frequent ED behaviors of almost all types, in addition to more severe overall ED psychopathology. Future research is also needed to determine how the potential mechanisms underlying these subtype differences in AN can be effectively targeted in both treatment and prevention programs.

In conclusion, this study adds to the growing literature on the AN diagnostic subtypes, providing additional evidence that the binge eating/purging subtype of AN exhibits greater ED psychopathology in the form of more frequent restrictive eating behaviors. While the exact role of these behaviors within conceptual maintenance models of ANbp requires further empirical investigation, professionals working clinically with individuals with AN may wish to assess and monitor the variety of behaviors in which their clients engage to restrict their food intake, noting that the configuration of these behaviors may differ according to subtype and represent a non-weight-based marker of the severity of ED psychopathology.

Acknowledgments

References

1. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4. Washington, DC: Author; 1994.

2. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 5. Washington, DC: Author; 2013.

3. Peat C, Mitchell JE, Hoek HW, Wonderlich SA. Validity and utility of subtyping anorexia nervosa. Int J Eat Disord. 2009; 42:590–594. [PubMed: 19598270]

4. Wonderlich SA, Joiner TE, Keel PK, Williamson DA, Crosby RD. Eating disorder diagnoses: Empirical approaches to classification. Am Psychol. 2007; 62:167–180. [PubMed: 17469896]

5. Root TL, Pinheiro AP, Thornton L, Strober M, Fernandez-Aranda F, Brandt H, et al. Substance use disorders in women with anorexia nervosa. Int J Eat Disord. 2010; 43:14–21. [PubMed: 19260043]

6. Herzog DB, Keller MB, Sacks NR, Yeh CJ, Lavori PW. Psychiatric comorbidity in treatment-seeking anorexics and bulimics. J Am Acad Child Adolesc Psychiatry. 1992; 31:810–818. [PubMed: 1400111]

7. Fassino S, Amianto F, Gramaglia C, Facchini F, Abbate Daga G. Temperament and character in eating disorders: Ten years of studies. Eat Weight Disord. 2004; 9:81–90. [PubMed: 15330074]

8. Forcano L, Avarez E, Santamaría JJ, Jimenez-Murcia S, Granero R, Penelo E, et al. Suicide attempts in anorexia nervosa subtypes. Compr Psychiatry. 2011; 52:352–358. [PubMed: 21683172]

9. Le Grange D, Lock J, Agras WS, Moye A, Bryson SW, Jo B, et al. Moderators and mediators of remission in family-based treatment and adolescent focused therapy for anorexia nervosa. Behav Res Ther. 2012; 50:85–92. [PubMed: 22172564]

10. Carter JC, Mercer-Lynn KB, Norwood SJ, Bewell-Weiss CV, Crosby RD, Woodside DB, Olmsted MP. A prospective study of predictors of relapse in anorexia nervosa: Implications for relapse prevention. Psychiatry Res. in press.

11. Ward A, Campbell I, Brown N, Treasure J. Anorexia nervosa subtypes: Differences in recovery. J Nerv Ment Dis. 2003; 191:197–201. [PubMed: 12637848]

12. Eddy KT, Dorer DJ, Franko DL, Tahilani K, Thompson-Brenner H, Herzog DB. Diagnostic crossover in anorexia nervosa and bulimia nervosa: Implications for DSM-V. Am J Psychiatry. 2008; 165:245–250. [PubMed: 18198267]

13. Fichter MM, Quadflieg N. Long-term stability of eating disorder diagnoses. Int J Eat Disord. 2007; 40:S61–S66. [PubMed: 17702021]

14. Eddy KT, Keel PK, Dorer DJ, Delinsky SS, Franko DL, Herzog DH. Longitudinal comparison of anorexia nervosa subtypes. Int J Eat Disord. 2002; 31:191–201. [PubMed: 11920980]

15. Garfinkel PE, Moldofsky H, Garner DM. The heterogeneity of anorexia nervosa: Bulimia as a distinct subgroup. Arch Gen Psychiatry. 1980; 37:1036–1040. [PubMed: 6932188]

16. Cassin SE, von Ranson KM. Personality and eating disorders: A decade in review. Clin Psychol Rev. 2005; 25:895–916. [PubMed: 16099563]

17. Le Grange D, Crosby RD, Engel SG, Cao L, Ndungu A, Crow SJ, et al. DSM-IV defined anorexia nervosa versus subthreshold anorexia nervosa (EDNOS-AN). Eur Eat Disord Rev. 2013; 21:1–7. [PubMed: 22847947]

18. First, M.; Spitzer, R.; Gibbon, M.; Williams, J. Structured Clinical Interview for DSM–IV Axis I Disorders: Patient Edition (SCIDI/P). New York: Biometrics; 1995.

19. Fairburn, CG.; Cooper, Z. The eating disorders examination. In: Fairburn, CG.; Wilson, GT., editors. Binge eating: Nature, assessment and treatment. 12. New York: Guilford Press; 1993. p. 317-331.

20. Wheeler L, Reis HT. Self-recording of everyday life events: Origins, types, and uses. J Pers. 1991; 59:339–354.

21. Liang KY, Zeger SL. Longitudinal data analysis using generalized linear models. Biometrika. 1986; 73:13–22.

22. Nielsen S, Møller-Madsen S, Isager T, Jørgensen J, Pagsberg K, Theander S. Standardized mortality in eating disorders – a quantitative summary of previously published and new evidence. J Psychosom Res. 1998; 44:413–434. [PubMed: 9587884]

23. Bulik CM, Sullivan PF, Kendler KS. An empirical study of the classification of eating disorders. Am J Psychiatry. 2000; 157:886–895. [PubMed: 10831467]

24. Crow SJ, Swanson SA, Peterson CB, Crosby RD, Wonderlich SA, Mitchell JE. Latent class analysis of eating disorders: Relationship to mortality. J Abnorm Psychol. 2012; 121:225–231. [PubMed: 21707126]

25. Peterson CB, Crow SJ, Swanson SA, Crosby RD, Wonderlich SA, Mitchell JE, et al. Examining the stability of DSM-IV and empirically derived eating disorder classification: Implications for DSM-5. J Consult Clin Psychol. 2011; 79:777–783. [PubMed: 22040286]

26. Olatunji BO, Broman-Fulks JJ, Ciesielski BG, Zawilinski LL, Shewmaker S, Wall D. A taxometric investigation of the latent structure of eating disorders. Psychiatry Res. 2012; 197:97–102. [PubMed: 22406392]

27. Stein KF, Corte CM. Ecological momentary assessment of eating-disordered behaviors. Int J Eat Disord. 2003; 34:349–360. [PubMed: 12949927]

Table 1

Participant Demographics

	ANr (n = 73)		ANbp (n = 45)		t (116)	p
	M	SD	M	SD		
Age (years)	24.42	7.99	26.78	8.84	−1.49	.138
BMI (kg/m²)	17.20	1.07	17.07	0.97	0.65	.515
EDE Global	2.43	1.27	3.28	1.15	−3.63	<.001
EDE Restraint	2.33	1.59	3.55	1.33	−4.48	<.001
EDE Eating Concern	1.80	1.30	2.54	1.33	−2.98	.003
EDE Shape Concern	2.79	1.61	3.49	1.48	−2.38	.019
EDE Weight Concern	2.81	1.57	3.53	1.60	−2.39	.018
Global Assessment of Functioning	58.03	7.42	52.62	8.14	3.70	<.001
	n	%	n	%	χ^2	p
Ethnicity (Caucasian)	71	97.3	43	95.6	0.25	.884
Marital Status (single/never married)	59	80.8	30	66.7	5.80	.326
Education (college degree)	25	34.2	24	53.3	15.63	.029

Note. BMI = Body Mass Index; EDE = Eating Disorder Examination interview.

Table 2

Univariate Comparisons of AN Subtypes Across Eating Behaviors

	ANr	ANbp				
	M (SD)	M (SD)	OR	Lower, Upper 95% CI	Wald χ^2 (df = 1)	p
Binge Eating Episodes (per day)	0.05 (0.13)	0.35 (0.45)	7.16	3.74, 13.74	35.19	**<.001**
Self-Induced Vomiting Episodes (per day)	0.04 (0.11)	0.68 (0.79)	21.56	9.86, 47.18	59.08	**<.001**
8 hours without eating (days/week)	0.65 (1.23)	1.41 (2.18)	2.21	1.08, 4.51	4.70	**.030**
Eating < 1200 calories (days/week)	1.94 (2.65)	2.78 (2.84)	1.65	0.86, 3.17	2.23	.136
Skipping meals (meals/day)	0.39 (0.53)	0.59 (0.56)	1.69	1.05, 2.70	4.69	**.030**
Limiting calories at meals (% of meals)	42.56 (36.28)	56.96 (36.18)	1.82	1.01, 3.28	3.93	**.047**
Limiting fat grams at meals (% of meals)	30.52 (33.17)	40.59 (38.39)	1.47	0.77, 2.79	1.38	.241
Limiting carbohydrates at meals (% of meals)	22.74 (29.73)	28.33 (34.71)	1.16	0.59, 2.29	0.19	.661
Eating as little as possible (% of meals)	24.18 (29.96)	43.15 (32.45)	2.49	1.42, 4.39	10.01	**.002**

Note: OR = odds ratio; CI = confidence interval. Odds ratios are coded such that odds ratios greater than 1 indicate that ANbp is more likely than ANr to report a given behavior. Bolded p-values are considered statistically significant.