

Predictors of psychopathology response in atypical anorexia nervosa following inpatient treatment: A propensity score matching study of weight suppression and weight loss speed

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Abstract

Introduction: This study examines weight suppression (WS) and weight loss speed (WLS) in atypical anorexia nervosa (AN) and its implications for treatment outcomes, compared to people with AN and bulimia nervosa (BN).

Method: A mixed cross-sectional and prospective design was employed, assessing WS and WLS in people with atypical AN, AN, and BN. Participants were matched for age, gender, age of onset, and disorder duration. Clinical measurements and eating disorders questionnaire (EDE-Q) scores were employed to evaluate the response to treatment.

Results: Individuals with atypical AN exhibited WS patterns similar to AN, distinct from BN. Rapid WLS predicted clinical responses in atypical AN and BN, underscoring its treatment relevance. Atypical AN showed higher eating psychopathology scores than AN or BN, emphasizing the need for a reframed diagnosis.

Discussion: Understanding atypical AN's connection to restrictive behaviors and weight loss informs screening, assessment, and treatment practices. Recognition of atypical AN's severity and adoption of tailored approaches are essential for recovery. This study highlights the significance of WS and WLS in atypical AN treatment outcomes, offering insights into clinical practice and care. The proposal to reframe atypical AN as a restrictive eating disorder emphasizes its clinical relevance.

Public Significance Statement: The phenomenon of weight suppression, involving the discrepancy between past highest weight and current weight, has garnered attention due to cultural pressures emphasizing fitness and appearance. This study focuses on its implications in atypical anorexia nervosa, aiming to uncover the relationship between WS, its speed, and treatment outcomes. The investigation contributes insights into tailored interventions for atypical anorexia nervosa and enriches the understanding of this complex disorder's dynamics.

KEYWORDS

anorexia nervosa, atypical anorexia nervosa, bulimia nervosa, treatment response, weight loss speed, weight suppression

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1 | INTRODUCTION

Weight suppression (WS) is defined as the discrepancy between an individual's past highest weight at the current height and their current weight, excluding factors like pregnancy or medications (Butryn et al., 2006). There has been a growing interest in the literature on WS, due to its implications for metabolism, appetite, and psychological well-being (Lowe et al., 2018). It has been suggested that a biobehavioral mechanism could link WS to future weight gain, with negative effects on motivation to change dysfunctional compensatory behaviors (Lowe et al., 2018). WS appears to be a widespread phenomenon and is considered a specific risk factor for eating disorders (EDs), especially for those patients who have restrictive behaviors, as in the case of anorexia nervosa (AN) and bulimia nervosa (BN) diagnosis, but this does not seem to hold for binge eating disorder (BED) (Stice et al., 2020). Moreover, WS and weight loss speed (WLS) have been associated with psychological core clinical variables such as body dissatisfaction and drive for thinness, as well as long-term bulimic symptoms, and outcome rates (Lowe et al., 2011; Solmi et al., 2018; Wildes & Marcus, 2012). However, the data in the literature are scarce for ED categories other than AN and BN, and limited data are available for atypical AN (Walsh et al., 2022; Whitelaw et al., 2018).

Atypical AN is defined as an intense fear of gaining weight or becoming fat, with body image disturbance, and significant weight loss, without significantly low body weight (American Psychiatric Association, 2013). Atypical AN is characterized by a clinical connection between total weight loss and recent weight loss with physical complications and restrictive behaviors (Whitelaw et al., 2018). Moreover, a growing body of research has been focused on the evaluation of clinical features of atypical AN, looking for the possible role that this category could have in reframing ED diagnoses considering the presence of AN psychopathology, restrictive behaviors, and a normal BMI as in BN (Birgegård et al., 2023).

Given the existing literature, our aim was to investigate specific associations between atypical AN, WS, and WLS. We aimed to clarify how these factors characterized restrictive behaviors, weight reduction, and their potential implications for diagnostic classification at the beginning of inpatient treatment. Additionally, we explored the longitudinal effects of these associations by analyzing data at the end of treatment and during a 6-month follow-up. We hypothesized that, because of clinical differences (e.g., weight status, level of restriction) between AN, BN, and atypical AN, each will show unique patterns of WS and WLS and that WS and WLS will be differently related to treatment outcomes across the three disorders.

2 | METHOD

This is a longitudinal study, with data collected at hospitalization, discharge, and at 6 months follow-up. However, the analyses employ a cross-sectional design to test group associations at a single time point, utilizing hospitalization data to transform repeated measures into a single time point for analysis.

The study recruited participants consecutively referred to the ED Unit of the Casa di Cura Villa Margherita (Arcugnano-Italy) between June 2014 and January 2023. The inclusion criteria were (a) Diagnoses of AN, BN, or atypical AN according to DSM-5 criteria (American Psychiatric Association, 2013); (b) age between 14 and 60 years; and (c) no severe psychiatric (i.e., schizophrenia or bipolar disorder) or medical comorbidity, neurological trauma or disorder. Point (c) was evaluated before the start of the inpatient treatment with personal clinical records and psychiatric evaluation. An informed consent was signed by each participant (and their parents, if the patients were below 18 years of age).

The ED diagnoses were made by fully trained psychiatrists with the Structured Clinical Interview (SCID) for DSM-5 (Shankman et al., 2018). For the atypical AN diagnosis, a reduction of at least 10% of body weight was decided as the definition of significant weight loss, with no lifetime diagnosis of AN. Other criteria were in accordance with the DSM-5 definition (Walsh et al., 2022).

2.1 | Measures of eating disorder symptoms

The EDE-Q, a 28-item self-report questionnaire, measures eating disorder concerns (Fairburn & Beglin, 1994). It comprises four subscales (Restraint, Eating Concern, Shape Concern, and Weight Concern) and an overall global score. High scores indicate more severe eating issues. In this sample, reliability was very good: restraint $\alpha = .88$, eating concern $\alpha = .81$, shape concern $\alpha = .90$, weight concern $\alpha = .84$, global score $\alpha = .93$.

2.2 | Treatment

Treatment was based on a cognitive-behavioral multidisciplinary approach for eating disorders (Halmi, 2009; Linardon & Brennan, 2017). It involves weekly individual therapy, daily group therapy, nutritional counseling, nursing care, meal planning, family treatment, psychoeducational group therapy, and, if necessary, psychopharmacologic treatment (Todisco et al., 2020). Personalized interventions, such as mindfulness for emotional or cognitive challenges and sensorimotor therapy for those with a traumatic history, may also be integrated.

2.3 | Weight suppression, weight loss speed, and treatment response definitions

The clinical staff collected weight and height measurements, along with patients' weight history, including maximum and minimum weights at their current height. They also noted the time between the maximum and minimum weight. WS was calculated as the difference between maximum weight and current weight, adjusted to BMI based on height. WLS was determined as the ratio of WS in terms of BMI to the duration (in months) of weight loss. For both WS and WLS, only the most recent weight loss episodes were considered, especially in

cases of multiple episodes or extended illness duration (Solmi et al., 2018).

Treatment response at the end of the hospitalization and outcome at 6 months follow-up was defined by the achievement of an EDE-Q global score <2.3, corresponding to the mean + 1 standard deviation of the score of the normative Italian population (Calugi et al., 2017), a methodology suggested by previous literature (Swenne, 2018).

2.4 | Statistics

The propensity score matching (1:1 match with a tolerance of .5 for each variable) was performed to adjust the significantly different baseline characteristics of the participants and without replacement (Vanderweele, 2006). For this study, we considered the atypical AN cohort as the reference group and applied a matching procedure for age, gender, age of onset, and duration of the disorder. We paired each person with an atypical AN diagnosis with a person with a diagnosis of AN restrictive subtype (ANR) and in a second round with a BN diagnosis (1:1:1). We selected these specific populations looking for similarities with pure restrictive behaviors (ANR) and normal BMI with binge-purge behaviors (BN), the main specific characteristics of atypical AN. The balance diagnostics were completed for the propensity score method.

An ANOVA was applied to analyze baseline characteristics, post hoc analyses were adjusted for multiple testing using Bonferroni correction, and partial eta-squared (η_p^2) was used for effect size. The chi-square test was used for categorical data. Longitudinal evaluations were used in logistic binary regression to examine the association between WS, WLS, and treatment response at the end of hospitalization and after 6 months, as suggested by previous literature (Swenne, 2018). The level of significance for independent variables was set at .05. Statistical analysis was performed using SPSS 25.0.

3 | RESULTS

3.1 | Baseline evaluation

A total sample of 58 cisgender women with a diagnosis of atypical AN was included in the study. They were matched with 58 cisgender women with a diagnosis of ANR and 58 peers with a diagnosis of BN from a database of 336 people (ANR = 206, BN = 130) hospitalized in the same period, yielding a total sample size of 174 participants. People with atypical AN and BN reported average higher eating psychopathological scores than ANR, despite similar demographic data. Looking at eating behaviors, 31 atypical AN patients reported a restrictive behavior with no binge or purge episode in their history, while 27 atypical AN patients reported binge-purging behaviors, with

TABLE 1 Comparison of demographic and psychological data between diagnostic groups.

	Atypical AN	ANR	BN	<i>F</i> (<i>p</i> , η_p^2)	Post hoc (<i>p</i>)
Age, years	25.33 (11.08)	24.38 (9.68)	24.07 (8.84)	.81 (.448, .020)	
BMI, kg/m ²	19.89 (1.17)	14.54 (1.70)	22.44 (4.07)	117.97 (<.001, .576)	AN < AAN (<.001) AN < BN (<.001) AAN < BN (<.001)
Age of onset, years	17.67 (6.64)	17.42 (6.87)	16.04 (3.03)	1.09 (.340, .023)	
Duration of the disorder, years	8.14 (9.96)	7.92 (8.61)	7.37 (7.80)	.15 (.858, .010)	
BMI maximum, kg/m ²	25.02 (3.13)	21.33 (3.06)	25.57 (5.14)	15.23 (<.001, .114)	AN < AAN (.001) AN < BN (<.001)
EDE-Q					
Restraint	3.85 (1.86)	3.51 (1.87)	3.38 (1.89)	.92 (.401, .019)	
Eating Concern	3.73 (1.59)	2.63 (1.42)	3.92 (1.58)	10.20 (<.001, .099)	AN < AAN (.001) AN < BN (<.001)
Shape Concern	5.01 (1.38)	4.18 (1.42)	4.94 (1.43)	5.54 (.005, .051)	AN < AAN (.007) AN < BN (.027)
Weight Concern	4.45 (1.61)	3.73 (1.57)	4.38 (1.42)	3.38 (.037, .041)	AN < AAN (.050)
Total score	4.26 (1.44)	3.51 (1.34)	4.15 (1.35)	4.43 (.013, .045)	AN < AAN (.017)
Time weight loss, month	6.72 (7.29)	7.46 (8.13)	7.17 (6.58)	.104 (.901, .002)	
WS, kg	5.13 (2.97)	6.79 (3.27)	3.13 (3.56)	15.19 (<.001, .186)	BN < AN (<.001) BN < AAN (.007)
WLS, kg/months	1.71 (1.93)	1.92 (1.71)	.65 (.95)	7.39 (.001, .112)	BN < AN (.004) BN < AAN (.004)

Abbreviations: AN, anorexia nervosa; ANR, restrictive subtype; BN, bulimia nervosa; η_p^2 , partial eta-squared; WLS, weight loss speed; WS, weight suppression.

Note: Means and standard deviations are reported. Post hoc analyses were Bonferroni corrected.

a binge frequency of 4.85 ± 1.29 [range 1–6] episodes per week and a purge frequency of 4.49 ± 1.46 [range 1–6] episodes per week. Patients with BN reported similar eating behaviors, with a binge frequency of 5.24 ± 1.05 [range 1–6] episodes per week and a purge frequency of 4.87 ± 1.43 [range 1–6] episodes per week (Table 1).

Looking at the WS and WLS we found specific differences between groups, showing different patterns of behaviors in the three groups. People with ANR showed a larger amount of weight suppressed than others, while BN reported a minor WLS than both ANR and atypical AN—that performed similarly (Table 1).

3.2 | Longitudinal evaluation

In the longitudinal evaluation, no significant differences were observed with regard to the duration of hospitalization (atypical AN = 95.00 ± 45.85 days, ANR = 96.19 ± 58.12 , BN = 90.28 ± 50.78 , $F = .14$, $p = .868$). Regarding the reduction of the EDE-Q global score, at admission, no patient had an EDE-Q global score lower than 2.3. Regarding the change in this score, we found that there was a marked reduction at discharge in 23 out of 58 participants with atypical AN (39.7%), 10 for ANR (17.2%), and 13 for BN (22.4%), without significant difference between groups: atypical AN EDE-Q global score 2.43 ± 1.47 ; ANR 2.87 ± 1.30 ; BN 2.66 ± 1.40 ; $F(2, 151) = 1.089$, $p = .340$, $\eta_p^2 = .018$. At 6 months follow-up, EDE-Q global score was under the limit chosen for 29 atypical AN participants (50%), 16 ANR (27.6%), and 21 BN (36.2%), without significant difference between groups: atypical AN EDE-Q global score 2.20 ± 1.50 ; ANR 2.65 ± 1.47 ; BN 2.63 ± 1.57 ; $F(2, 151) = .927$, $p = .399$, $\eta_p^2 = .020$. No significant differences emerged in the distribution (at discharge $\chi^2 = 5.03$, $p = .081$, at 6 months $\chi^2 = 3.61$, $p = .164$).

3.3 | Logistic regression for WS and WLS

Among individuals with atypical AN, we found that WLS was a predictor of clinical response, both at discharge and at 6 months. While WS was a predictor of clinical responses for BN only at the 6-month follow-

up. No significant results were found looking at the interaction between diagnoses and outcome at discharge and at 6 months (Table 2).

4 | DISCUSSION

The main results of the study indicated that individuals with atypical AN exhibited weight reduction patterns similar to those with ANR and distinct from those with BN. This finding suggests that there might be common factors involved in weight loss among these disorders, possibly related to the underlying mechanisms of restrictive eating behaviors. However, several differences also emerged, pointing out the necessity of a clearer definition of atypical AN (Eiring et al., 2021; Hay, 2023).

Rapid WLS could be a crucial predictor of positive clinical responses in individuals with atypical AN. This finding suggests that the pace at which weight is lost may have implications for treatment success and the overall recovery process, perhaps because higher WS and WLS allow early detection and referral to treatment. This was reported in adolescents (Whitelaw et al., 2018), but our data suggest that this effect could be replicated also in young adults. While the predictive role of WS is still preliminary for atypical AN, the evidence is inconclusive for the other ED diagnoses (Gorrell et al., 2019; Lowe et al., 2018). More robust data seem to be present for bulimic eating disorders (Keel et al., 2019), in which WS prospectively predicts illness trajectory.

These findings highlight the importance of considering WS and its rate as crucial indicators for treatment planning in individuals with atypical AN. Healthcare professionals should integrate weight history, including WS and WLS into their assessment approaches, to potentially enhance the well-being and treatment success for individuals with atypical AN, similar to what has been observed in those with AN and BN (Solmi et al., 2018).

Our data underscore the necessity to reconsider the current categorical classifications, which may be heavily influenced by weight (Johnson-Munguia et al., 2023). These findings align with recent proposals to reframe atypical AN as a restrictive eating disorder, emphasizing the role of reduced energy intake in the development of dysfunctional behaviors and thoughts (Birgegård et al., 2023). This

	Atypical AN		ANR		BN	
	b (SE)	OR (p)	b (SE)	OR (p)	b (SE)	OR (p)
At discharge						
	$R^2 = .14$		$R^2 = .07$		$R^2 = .05$	
WS	-.14 (.12)	.87 (.225)	-.31 (.24)	.74 (.207)	.01 (.12)	1.01 (.911)
WLS	.56 (.23)	1.76 (.016)	.17 (.32)	1.18 (.601)	-.21 (.51)	.81 (.686)
At 6 months follow-up						
	$R^2 = .27$		$R^2 = .09$		$R^2 = .36$	
WS	.13 (.12)	1.13 (.281)	-.16 (.15)	.85 (.288)	.82 (.32)	2.27 (.009)
WLS	.85 (.32)	2.35 (.007)	.33 (.26)	1.39 (.196)	-.43 (.79)	.65 (.582)

TABLE 2 Logistic regression analyses for each diagnostic group.

Abbreviations: AN, anorexia nervosa; ANR, restrictive subtype; BN, bulimia nervosa; WLS, weight loss speed; WS, weight suppression.

concept is also supported by biological markers of malnutrition (Garber et al., 2019) and neuropsychological embodiment evaluation (Meneguzzo et al., 2023).

The study's limitations include a small sample size, a specific evaluation time frame, an exclusive focus on clinically severe inpatients, and the absence of specific outcome features for different diagnoses. Future research should involve larger, more diverse samples and different longitudinal assessments such as neuropsychological features to bolster these initial findings. Additionally, the study lacks data on the prior history of bulimia nervosa in those with anorexia nervosa and relies on self-reported weight history from participants.

5 | CONCLUSION

Implementing more specific screening protocols that inquire about weight history, weight suppression, and the pace of weight loss can help identify individuals at risk for or already experiencing atypical AN, whose severity of illness may not be appreciated due to their normal weight. As such, including WS and WLS to other indicators of the severity of the disorder, such as restrictive eating behaviors, disturbed body image, and psychological distress, is paramount in the diagnostic and therapeutic process.

AUTHOR CONTRIBUTIONS

Paolo Meneguzzo: Conceptualization; formal analysis; investigation; methodology; validation; visualization; writing – original draft. **Athos Antoniaides:** Data curation; visualization; writing – review and editing. **Alice Garolla:** Data curation; investigation; writing – review and editing. **Federica Tozzi:** Data curation; visualization; writing – review and editing. **Patrizia Todisco:** Conceptualization; funding acquisition; resources; writing – review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

The study received ethics approval from the Vicenza Ethics Committee (47/21).

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