

Suicidality in Adolescents With Onset of Anorexia Nervosa: From the Conceptualization of the Symptom to Clinical Practice

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Abstract

Purpose: Anorexia nervosa (AN) is an eating disorder (ED) that is divided in a restrictive (R-AN) and atypical (A-AN) form depending on the body mass index (BMI). In 100 adolescents with AN, we reviewed the diagnosis (R-AN and A-AN) in relation to different diagnostic criteria (absolute BMI, DSM-5 criteria, European Guidelines and Cacciari percentile curves) and we studied the prevalence of suicidality (suicidal thoughts and behaviours). We also observed the association between suicidality and severity of AN symptoms and psychiatric comorbidities.

Methods: We subdivided AN in R-AN and A-AN, considering the four diagnostic criteria previously described. We used the Fisher's exact test and the Mann-Whitney test for categorical and continuous variables, and we applied multivariate analysis of variance and covariance.

Results: Thirty-one % of patients changed diagnosis from R-AN to A-AN depending on which diagnostic criteria was used. Twenty-seven % of patients presented suicidality and they showed greater severity of specific AN psychopathology.

Conclusions: Categorization of the AN in childhood can change depending on the diagnostic criteria used. Suicidality is independent from BMI, and seems to be related to specific ED psychopathology and psychiatric comorbidity. These data confirm the need to conceptualize the pathology in a different way and improve the therapeutic intervention. Our findings also highlight the importance of screening for suicidality among children and adolescents at onset of AN to prevent suicide.

Level of evidence: level IV

Introduction

The term "suicidality" is used to describe a wide spectrum of suicidal manifestations, which extends from ideation to acts (self-aggressive behaviors, parasuicide and suicide attempts) [1] and represent a condition of health urgency, particularly in adolescence. The prevalence rates for suicidality in adolescence are between 15% and 30% according to both American [2] and European [3] data. Many authors have described the relationship between self-aggressive and suicidal behaviours, ranging from cutting to suicide. According to Joiner, self-aggression would represent a painful event which, repeated over time, would lead to a habit of pain and a reduction in the fear of death, thus increasing the risk of complete suicide [4]. Many studies have analyzed self-aggression across a spectrum that includes both direct behaviors (cutting or burning of the skin) and indirect behaviors as eating disorders (ED), substance abuse and risky sexual behavior [5]. In patients with ED, suicide can be considered the most frequent cause of death rather than hunger or complications of weight loss [6] and appears to occur more frequently in the later stages of the disease and in periods of symptomatic remission [7]. In addition, about half of ED patients show suicidal ideation, with up to 26% of patients eventually attempting suicide [8, 9]. Specifically, the literature indicates that bulimia and anorexia nervosa (AN) with elimination behaviors represent the pathologies more at risk of suicide due to the apparently "active" nature of these ED types [10, 11]. Moreover, the risk of suicidality among patients suffering from restrictive AN (R-AN) correlates with low weight [12, 13]. A further factor at play in complicating the interpretation of the existing literature on the topic is the inconsistency of the criteria used to differentiate AN patients into R-AN and atypical AN (A-AN), especially considering that those definitions differ between subjects in developmental age and the adults. In fact, as described by some authors [14, 15, 16], it is possible to diagnose, depending on the diagnostic criteria used in the evaluation of body mass index (BMI), R-AN rather than A-AN. According to the same authors, however, there are no differences between the two forms of ED in terms of psychopathology and psychiatric comorbidity, independent of the BMI [14, 15, 16].

The overarching objective of this study is to better clarify the relationship between suicidality, AN type and severity of ED symptoms. In detail, we aimed to: a) evaluate how the diagnosis of the AN subtype varies depending on the adoption of the different currently existing diagnostic criteria; b) estimate the distribution of the two diagnostic subtypes in a sample of adolescents suffering from AN; c) determine the prevalence of suicidality among children and adolescents admitted to the Child and Adolescent Psychiatry Unit (CAPU) of the Children's Hospital A. Meyer in Florence and diagnosed with R-AN or A-AN; and d) study the association between severity of ED symptoms, psychiatric comorbidity and suicidality, overall and in relation to the diagnostic subtype (R-AN vs. A-AN).

Our initial hypothesis was that suicidality were related neither to weight changes nor to malnutrition, as assessed by BMI, but rather, primarily to patients psychopathological aspects. In line with other studies [17, 18] that conceptualize the severity of AN independently of weight, our starting hypothesis is consistent with the concept of the centrality of dissatisfaction with weight and shape and food restriction in determining suicidality among AN patients.

Methods

Selection of subjects

The study was approved by the Pediatric Ethics Committee of the Tuscany Region. We enrolled 100 adolescent inpatients (11 males and 89 females) aged 11–18 years (median 15 years) consecutively admitted to the CAPU of the Children's Hospital A. Meyer in Florence between January 2016 and December 2020. A retrospective chart review was completed. Selection bias was contained by including in the study a consecutive series of patients meeting pre-defined inclusion criteria. Confounding and collinearity of variables were considered by conducting multivariable-adjusted analyses (MANOVA and MANCOVA). All patients under the age of 18 years who received a primary diagnosis of AN, according to DSM-5 criteria [19] were selected. Patients were included if they met the following criteria: (a) age \leq 18 years; (b) current diagnosis of AN; (c) absence of significant current and/or lifetime comorbid psychiatric disorders such as bulimia nervosa, substance abuse disorder and schizophrenia; (d) absence of non-ED-related severe physical disorders; (e) absence of intellectual disability; (f) no history of endocrine disorders; (g) illness duration $<$ 3 years. On admission, a diagnostic assessment of each inpatient was performed by a multidisciplinary team. All patients underwent an anthropometric and clinical evaluation, a psychiatric, family, psychopathological and nutritional interview and a psychological

and eating test administration. Age at onset was defined as the age at which each patient first met the DSM-5 diagnostic criteria for AN and was evaluated through a direct clinical interview. To confirm the reliability of the collected clinical data, the assessment also involved the caregivers. Diagnosis and psychiatric comorbidities were formulated according to the Italian version of the Schedule for Affective Disorders and Schizophrenia for School-Age Children/Present and Lifetime Version (K-SADS-PL) [20], which follows DSM-5 criteria [19].

Sociodemographic and clinical variables at admission

Sociodemographic and clinical variables used for the present study included: nationality, age, gender, vital signs, presence of coexisting medical conditions, history of psychiatric diagnosis, family history of ED or other psychiatric diagnosis. For each patient, we retrospectively collected data from the medical reports (software C7) at the time of the assessment.

Anthropometrics

Weight and height were measured by nursing staff and were used to calculate percentile and BMI. Percentile BMI for age (pBMI) was determined using the 2000 Centers for Disease Control and Prevention growth charts [21]. In addition, we used the percentile curves by Cacciari [22], which allowed the classification of weight, height and pBMI according to the reference for the Italian population. The A-AN diagnosis refers to an intense fear of weight gain and an extreme restriction of food intake without very low body weight and the BMI results > 18.5 per adult population and > at the 5th percentile for children and adolescents [19]. In order to investigate how the diagnosis of R-AN and A-AN differs according to the different existing criteria, we classified the study population considering four different BMI cut-offs: absolute BMI, BMI below the 5th percentile (according to DSM-5 criteria [19]), BMI lower than 10th percentile according to the European guidelines [23], and BMI lower than 10th percentile considering the Cacciari percentile curves [22].

Psychometric measures

The assessment included the following psychometric tests: (i) the Eating Disorder Inventory, 3rd version (EDI-3) for the 13-18-year-old age group, according to the questionnaire administration criteria [24]; (ii) the K-SADS-PL interview [20]; and the (iii) The Italian version of the Columbia-suicide severity rating scale (C-SSRS) [25] administered by psychiatric residents in the first 2 days after admission to the psychiatric ward. Based on the C-SSRS scores [25], we differentiated the presence of suicidal ideation, intensity of ideation, self-injurious behaviours, and suicide attempts. The lethality of suicide attempts was based on actual mortality/medical harm and coded as follows:

0: no suicidal ideation or suicidal behaviour with no damage;

1: thoughts of death but not suicidal ideation and not suicidal behaviour;

2: sporadic unstructured suicidal ideation or minor suicidal behaviour, such as superficial self-cutting with minor physical damage (slight bleeding, scratching, bruising);

3: unplanned suicidal ideation or persistent thoughts of death or suicidal behaviour with moderate physical damage, need for medical attention (e.g., second degree burns, major vessel bleeding);

4: active suicidal ideation with some intent to act, without specific plan or preparatory acts or behaviour (anything beyond verbalization or thought, like assembling specific method (e.g., buying pills or gun) or preparing for death by suicide (e.g., giving things away, writing suicide note);

5: Active suicidal ideation with specific plan and intent or suicide attempt with minor physical damage and medical hospitalization required;

6: repeated major self-injurious behaviors, suicide attempts with severe physical harm and repeated suicide attempts.

Statistical analysis

The distribution of demographic, anamnestic and clinical variables was reported using percentages for categorical variables and medians and interquartile ranges for continuous variables. Differences between subgroups (e.g., between R-AN and A-AN patients, defined according to any of the four diagnostic criteria listed above) were assessed using the Fisher's exact test and the Mann-Whitney test for categorical and continuous variables, respectively. We then applied multivariate analysis of variance (MANOVA) and multivariate analysis of covariance (MANCOVA) to compare the overall distribution of the different EDI-3 scales [24] between R-AN vs. A-AN, and between patients who reported vs. did not report suicidality (suicidal behavior, suicidal ideation, self-cutting, and suicide attempts) in their anamnesis. All analyses were conducted using Stata version 14. All statistical tests were two-sided, and p-values were considered as statistically significant when lower than 0.05. There were no missing values in any of the variables used in the analysis, therefore no imputation of missing values was needed.

Results

Anthropometrics and clinical variables at admission

In the study period, 138 patients with onset of AN according to DSM-5 criteria [19] were selected. Thirty-eight patients were excluded from study sample due to incomplete clinical data. Eventually, 100 patients were included in the study (89 females and 11 males), whose age ranged between 11.4 and 17.9 years (mean 15.0, median 14.6). The patients' mean weight, height, and BMI at admission were 42.8 kg, 163.5 cm, and 15.2 kg/m², respectively, and the mean percentage of weight loss, from the beginning of eating disorder symptoms to hospital admission, was 21.7%. The percentage of weight loss at admission did

not significantly differ between R-AN and A-AN patients, while the weight at the admission was higher among A-AN vs. R-AN patients, which determined the diagnosis formulation.

Diagnosis's comparison based on different weight cut-off

Overall, 69/100 (69%) patients were consistently diagnosed the same AN type (58 R-AN and 11 A-AN) regardless of which of the four diagnostic criteria was used. Instead, for 31/100 (31%) patients the diagnosis changed according to the diagnostic criterion that was used. In detail, considering a BMI cut-off for the diagnosis below 18.5, 89 patients (89%) and 11 (11%) matched the diagnosis of R-AN and A-AN, respectively. In BMI cut-off below the 5th percentile (according to DSM-5 diagnostic criteria) [19], 58 patients (58%) were diagnosed with R-AN and 42 patients (42%) were diagnosed with A-AN. By applying the European Guidelines [23] cut-off (BMI below the 10th percentile), 66 (66%) and 34 (34%) patients met the diagnostic criteria for R-AN and A-AN, respectively. Finally, according to the diagnostic criteria based on Cacciari [22] BMI curve (percentile below 10th), the two different diagnoses, R-AN and A-AN, were attributed to 79 patients (79%) and 21 patients (21%), respectively (Table 1).

Psychopathological features

In the MANOVA analysis, R-AN and A-AN patients defined according to the DSM-5 diagnostic criteria [19], tended to differ ($p = 0.058$) in terms of how they scored in the composite scales of the EDI-3 questionnaire [24]. In detail, the mean score was higher among A-AN vs. R-AN patients for each of the six EDI-3 composite scales [24], the largest difference being observed for the "Eating concerns" and "Interpersonal problems" composite scales. The same pattern emerged (MANOVA p -value = 0.020) when comparing restrictive R-AN and A-AN patients defined according to the European Guidelines criteria. Instead, such pattern did not emerge in the comparison between R-AN and A-AN classified considering absolute BMI and Cacciari percentiles [22] BMI cut-off (Table 2).

A total of 48/100 (48%) patients included in the study presented at least one psychiatric comorbidity (of these, 8 patients presented two or more comorbidities), including anxiety (23%), depression (18%), mood alteration not otherwise specified (2%), obsessive compulsive disorder (6%), post-traumatic stress disorder (2%), gender dysphoria (2%), bipolar disorder (1%) and other psychiatric comorbidities (2%). There were no significant differences in the frequency of psychiatric comorbidities between restrictive vs. atypical AN patients, regardless of which diagnostic criteria was used to discriminate the two AN type (Table 3).

Suicidality

A total of 27/100 patients (27%) presented suicidality as clinical feature, namely any of suicidal ideation (24%), clinical evidence of self-cutting (19%), or suicidal attempt (6%). One patient presented a history of multiple suicidal attempts and comorbidity with mood disorder non otherwise specified. All these 27 patients showed a positive C-SSRS score [25]: the score was 1 for 2 patients (2%), 2 for 12 patients (12%), 3 for 8 patients (8%), 5 for 1 patient (1%), and 6 for 4 patients (4%). Among the latter group, three patients reported a suicide attempt in their recent clinical history, and one patient reported multiple suicidal attempts (Table 3). As regarding anthropometrics features, patients reporting suicidality tended to weigh more at hospital admission than those who did not, although this comparison was not statistically significant (Table 4). The other anthropometric parameters did not differ between patients who reported vs. did not report suicidality in their anamnesis. Of the 27 patients reporting suicidality, a total of 19 (70.4%) presented at least one psychiatric comorbidity associated with AN. Patients with any psychiatric comorbidity associated with AN reported suicidality, more often than those without psychiatric comorbidity (p -value = 0.006). Suicidality was more frequent among patients with depression (p -value = 0.021) (Table 4). Notably, there were no differences in suicidality between patients with R-AN and A-AN regardless of the diagnostic criteria used to differentiate the two groups (Table 3). The MANOVA analysis highlighted that patients suicidality tended to associate with higher scores to the EDI-3 questionnaire [24], both in the single scales (eating disorder-specific and psychological trait scales) and in the composite ones (Table 5). Of note, this pattern was maintained upon adjusting for the diagnosis type (R-AN versus A-AN, defined according to any of the different criteria) in MANCOVA analysis. Furthermore, this pattern was confirmed when using the C-SSRS [25] score (dichotomized into 0 vs. ≥ 1) as parameter to evaluate the presence of suicidality (Table 5).

Discussion

Our study investigated the prevalence of suicidality in a group of adolescents with onset of AN. First, we evaluated the diagnostic conceptualization based on the present criteria distinguishing the R-AN forms from the A-AN. Furthermore, we investigated the prevalence of suicidality among different AN subtype. Additionally, we assessed the association between suicidality, severity of ED specific symptoms and psychiatric comorbidity in relation to the diagnosis (R-AN or A-AN).

Our data show that among children and adolescent inpatients, R-AN is the most frequent subtype of AN, regardless of the four diagnostic criteria used. It is interesting to note that despite the different presentation in terms of BMI, weight loss rate is not different in the two forms of the disease, as if to indicate that it is independent of the starting.

We focused on the diagnostic criterion because the DSM-5 [19] changed the BMI cut-off for AN diagnosis, from 17.5 kg/m² to 18.5 kg/m² for adults, in accordance with the definition of underweight in adult age proposed by the World Health Organization (WHO) [26]. Instead, in children and adolescents, age- and sex-adjusted BMI was considered more appropriate and underweight was defined as a BMI below the 5th percentile of age according to CDC growth charts [21]. This value makes the weight limit for diagnosing AN in children and adolescents stricter than in adults. Literature studies [27, 28, 29, 30] have suggested the use of the 10th percentile BMI criterion. Furthermore, in the evaluation of weight and height by age, geographical and ethnic variability must also be considered, as suggested by various pediatricians [22]. Patients who meet psychiatric criteria but who have a BMI > 18.5 or a pBMI > 5 should be diagnosed with A-AN [19]. We therefore tried to evaluate how the diagnostic distribution changes based on the BMI criterion used, noting that for 31% of patients the diagnosis changes. In addition A-AN shows EDI-3 higher scores [24] in the ED specific psychopathology and in "Ineffectiveness", in "Interpersonal

Problems", in "Affective Problems" and "Overcontrol". Our data confirm that symptoms in adolescents with AN are independent from weight severity [31], while the reduced ability to recognize the body and inner states may be the specific pathway that associates the identity problems and eating symptoms [17]. BMI appear to be a prognostic parameter in relation to mortality [32, 33, 34] and it is not clear what implication it may have with respect to AN psychopathology and suicidality. Persistently uncontrolled eating behaviors [35] or persistent low BMI [36] or severe psychiatric comorbidities especially in depressive disorders [8, 9, 37], seem more frequently related to suicide, especially in patients with a long-standing psychiatric history. Thus, an assessment of the relationships between general psychopathology, ED symptoms and childhood suicidality could clarify the implications of psychopathological and specific ED symptoms with respect to suicidality in young people with a short illness duration. In our sample there were no significant differences in the frequency of psychiatric comorbidities and suicidality between patients with R-AN and A-AN, consistent with literature [14, 15, 16].

The suicidality among our patients is according with literature data [38]. To our knowledge, no studies on adolescents have evaluated suicidality in A-AN. In our sample, suicidality is not influenced by BMI and therefore it is not differently distributed between R-AN and A-AN. In addition, regardless of the R-AN and A-AN diagnosis, patients with suicidality show higher scores on all EDI-3 [24] scales (disorder specific scale diet, psychological trait, and composite scale), and the suicidality is more common in patients with comorbidities particularly with depressive disorder. These results are also confirmed for subgroups with self-harm and suicide ideation / attempts.

We can provide a possible explanation for this starting from the Interpersonal Psychological Theory of Suicide (IPT) [39], which partly explains the relationship between suicidality and AN. It is theorized that the ability to commit suicide builds up over time through repeated experiences with painful and / or frightening events; these repeated experiences lead to the habit of pain and fear [40]. The frequent involvement of patients with AN in painful stimuli (intake food restriction) associated with a sense of ineffectiveness, interpersonal, emotional problems, general psychological maladjustment, can lead to a very high suicide capacity. In line with this theory [39], depressive symptoms such as social isolation, guilt, feeling a burden for others and the sense of lack of belonging, seem to be able to add to the greater insensitivity to pain felt by patients with AN, thus favoring a risk suicidal who is independent of body weight. Since interpersonal difficulties and comorbid psychiatric symptoms gradually worsen as the disease progresses, assessing the severity and implication of these factors in patients at symptom onset we think it could have significant clinical and treatment implications.

Strength and limits

A relevant aspect of our study is that the diagnosis of AN in developmental age can change depending on diagnostic criteria used. Moreover, it provides new information on the association between AN and suicidality among adolescents.

The limitations of the study are the small sample size and the cross-sectional nature of our investigation, with data collected retrospectively at the time of hospitalization, which may tend to elicit recall bias. A prospective study enrolling a larger and more heterogeneous population of ED adolescent patients and evaluating treatment outcomes by type of diagnosis and their predictors would be needed to confirm our findings.

What is already known on this subject?

To our knowledge, no adolescent studies have evaluated suicidality in the diagnosis of A-AN.

What this study adds?

Our work shows that the specific psychopathology of ED and suicidality are not influenced by BMI. In fact, we observed that patients with suicidality showed higher scores on all EDI-3 [24] scales (disorder-specific diet, psychological trait, and composite scale), regardless of the type of diagnosis (R-AN and A-AN). These data suggest that in developmental age suicidality should always be evaluated in adolescents and should be related to the psychopathological core and associated comorbidities.

Conclusions

Categorization of the AN in childhood and adolescent can change depending on the diagnostic criteria used. Suicidality and specific psychopathology of ED seem to be independent from BMI. Our findings also highlight the importance of screening for suicidality among adolescents at onset of AN. Moreover we suggest to pay attention to consider the A-AN a less severe disorder than R-AN. Conceptualizing AN pathology in a different way, may improve the therapeutic intervention, prevent suicidality, reduce the hospitalizations and decrease the costs for health services.

Declarations

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Conflicts of interest: the authors have no financial interest to disclose.

Availability of data and material: the dataset generated during the current study are available from the corresponding author on reasonable request.

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Tables

Table 1
Different diagnosis of restrictive anorexia nervosa (R-AN) and atypical anorexia nervosa (A-AN), considering the four different diagnostic criteria (absolute BMI, DSM-5, European guidelines and Italian guidelines according to Cacciari percentiles)

Diagnosis based on different diagnostic criteria					
	R-AN	%	A-AN	%	Total
Diagnosis based on Absolute BMI					
R-AN: BMI < 18.5 A-AN: BMI > 18.5	89	89%	11	11%	100
Diagnosis based on DSM V					
R-AN: BMI ≤ 5% CDC A-AN: BMI > 5% CDC	58	58%	42	42%	100
Diagnosis based on European Guidelines					
R-AN: BMI ≤ 10% CDC A-AN: BMI > 10% CDC	66	66%	34	34%	100
Diagnosis based on Italian Guidelines (Cacciari)					
R-AN: BMI ≤ 10% Cacciari A-AN: BMI > 10% Cacciari	79	79%	21	21%	100

Table 2

Comparison of EDI-3 questionnaire scores (reported as mean and standard deviation) between patients with restrictive and atypical anorexia nervosa (R-AN and A-AN) according to the different diagnostic criteria (absolute BMI, DSM-5 criteria, European Guidelines and Cacciari percentiles, see text for details) using multivariate analysis of variance (MANOVA).

	Whole study sample	Absolute BMI		DSM-V		European guidelines		Cacciari percentiles	
		R-AN (n = 89)	A-AN (n = 11)	R-AN (n = 58)	A-AN (n = 42)	R-AN (n = 66)	A-AN (n = 34)	R-AN (n = 79)	A-AN (n = 21)
Single EDI-3 scales									
Drive for thinness	73.2 (27.1)	71.9 (27.8)	83.8 (17.5)	65.8 (30.4)	83.4 (17.3)	67.9 (29.7)	83.4 (17.3)	71.1 (28.3)	81.1 (20.4)
Bulimia	42.9 (31.2)	40.9 (30.6)	59.2 (32.4)	36.3 (30.8)	51.9 (29.9)	38.0 (30.4)	52.4 (31)	39.8 (30.8)	54.7 (30.7)
Body dissatisfaction	64.6 (28.5)	62.9 (29.2)	77.9 (16.6)	58.5 (30.0)	73.0 (24.0)	60.3 (29.6)	73.0 (24.5)	62.5 (29.8)	72.3 (21.8)
Low self-esteem	61.5 (31.9)	60.6 (32.6)	69.1 (25.7)	56.4 (34.0)	68.6 (27.6)	58.7 (32.9)	67.1 (29.5)	58.9 (33.0)	71.5 (25.7)
Personal alienation	60.1 (31.5)	58.9 (32.2)	70.4 (23.9)	54.7 (33.5)	67.6 (27.2)	57.4 (33.2)	65.4 (27.6)	58.3 (33.0)	67.0 (24.6)
Interpersonal insecurity	67.4 (30.9)	67.0 (31.1)	70.9 (30.7)	63.1 (31.4)	73.4 (29.4)	65.8 (31.1)	70.5 (30.8)	65.2 (31.7)	75.9 (26.6)
Interpersonal alienation	58.8 (33.3)	57.8 (34.1)	66.9 (25.9)	54.4 (34.9)	64.9 (30.3)	55.8 (34.1)	64.6 (31.4)	56.4 (34.6)	68.0 (26.5)
Interoceptive deficits	68.4 (27.5)	67.0 (28.4)	79.3 (16.5)	65.7 (29.5)	72.1 (24.4)	67.5 (29.1)	70.2 (24.6)	66.7 (29.0)	74.9 (20.3)
Emotional dysregulation	57.7 (32.8)	56.5 (33.1)	67.4 (30.5)	54.0 (33.4)	62.7 (31.8)	57.5 (33.1)	58.1 (32.9)	56.6 (33.6)	61.8 (30.4)
Perfectionism	51.9 (31.0)	50.2 (30.2)	65.6 (35.8)	48.5 (31.2)	56.7 (30.5)	50.4 (31.3)	55.0 (30.6)	50.2 (30.2)	58.3 (33.9)
Ascetism	65.1 (32.1)	63.1 (33.0)	81.4 (16.2)	60.7 (34.8)	71.3 (27.0)	61.7 (33.8)	71.9 (27.6)	63.7 (32.7)	70.5 (29.7)
Maturity fears	59.4 (29.4)	58.9 (29.1)	59.4 (29.4)	54.3 (29.4)	66.5 (28.1)	56.8 (29.1)	64.6 (29.7)	59.7 (29.0)	58.5 (31.5)
MANOVA p-value		0.760		0.129		0.059		0.809	
Composite EDI-3 scales									
Eating concerns composite	66.4 (24.1)	64.4 (24.5)	82.6 (12.4)	60.6 (25.9)	74.5 (18.9)	61.3 (25.4)	76.2 (17.8)	63.8 (24.8)	76.1 (18.8)
Ineffectiveness composite	63.6 (30.8)	62.5 (31.6)	72.5 (23.2)	58.7 (33.4)	70.3 (25.8)	60.6 (32.4)	69.4 (27.0)	61.1 (32.2)	73.0 (23.3)
Interpersonal problems composite	64.6 (32.5)	63.8 (33.0)	71.5 (28.6)	59.9 (33.0)	71.1 (31.0)	61.8 (32.9)	70.0 (31.4)	61.8 (33.4)	75.0 (27.1)
Affective problems composite	67.2 (28.4)	65.9 (29.2)	77.5 (19.2)	64.6 (29.9)	70.8 (26.3)	66.2 (29.4)	69.1 (26.8)	65.2 (29.8)	74.5 (21.6)
Overcontrol composite	62.7 (29.6)	61.0 (29.7)	76.3 (26.3)	59.3 (31.6)	67.4 (26.2)	59.8 (30.6)	68.3 (27.0)	61.4 (29.1)	67.6 (31.5)
MANOVA p-value		0.253		0.058		0.020		0.357	

Table 3

Psychiatric comorbidities and suicidality: comparison between restrictive and atypical anorexia nervosa (R-AN and A-AN), based on the four different diagnostic criteria of BMI cut-off (absolute BMI, DSM-5 criteria, European Guidelines, Cacciari percentiles)

	All patients	Absolute BMI			DSM V			European Guidelines			Cacciari Percentiles		
		R-AN	A-AN	p-value	R-AN	A-AN	p-value	R-AN	A-AN	p-value	R-AN	A-AN	p-value
Psychiatric comorbidities													
No	52/100 (52%)	46	6	1.000	27	25	0.435	31	21	0.405	42	10	0.809
One	40/100 (40%)	36	4		26	14		29	11		31	9	
≥ 2	8/100 (8%)	7	1		5	3		6	2		6	2	
Suicidality													
No	73/100 (73%)	65	8	1.000	40	33	0.363	46	27	0.349	59	14	0.316
Yes	27/100 (27%)	24	3		18	9		20	7		20	7	
Self-cutting													
No	81/100 (23%)	72	9	1.000	45	36	0.439	51	30	0.282	64	17	1.000
Yes	19/100 (19%)	17	2		13	6		15	4		15	4	
Suicidal ideation													
No	76/100 (76%)	67	9	1.000	41	35	0.163	48	28	0.332	61	15	0.576
Yes	24/100 (24%)	22	2		17	7		18	6		18	6	
Suicidal attempt													
No	94/100 (94%)	85	9	0.054	55	39	0.796	63	31	0.561	76	18	0.105
One	5/100 (5%)	4	1		3	2		3	2		3	2	
Multiple	1/100 (1%)	0	1		0	1		0	1		0	1	
C-SSRS scores													
C-SSRS = 0	73/100 (73%)	65	8	1.000	40	33	0.363	46	27	0.349	59	14	0.581
C-SSRS ≥ 1	27/100 (27%)	24	3		18	9		20	7		20	7	

Table 4

Anthropometrics and clinical features of anorexia nervosa patients with suicidality, self-cutting, suicidal ideation/attempt, and with C-SSRS positive scores admission.

	Suicidality			Self-cutting			Suicidal ideation			Suicidal attempt			CSSRS at admission	
	No	Yes	p-value	No	Yes	p-value	No	Yes	p-value	No	Yes	p-value	No	Yes
Initial weight, kg	54 (50–58)	55 (50–60)	0.534	55 (50–60)	53 (47–58)	0.529	53 (49–59)	55 (51–59)	0.462	54 (50–58)	57 (52–61)	0.266	54 (50–58)	55 (50–60)
Weight at admission, kg	42 (38–47)	43 (37–47)	0.370	42 (38–47)	42 (37–46)	0.676	42 (38–47)	43 (37–47)	0.526	42 (37–46)	49 (42–53)	0.070	42 (38–47)	43 (37–47)
Weight loss, %	20 (16–28)	22 (16–28)	0.858	21 (16–28)	19 (16–27)	0.871	21 (16–28)	21 (15–29)	0.897	21 (16–28)	17 (13–26)	0.313	20 (16–28)	22 (16–28)
Comorbidities														
None	44 (60.3%)	8 (29.6%)		46 (56.8%)	6 (31.6%)		45 (59.2%)	7 (29.2%)		52 (55.3%)	0 (0%)		44 (60.3%)	8 (29.6%)
One	26 (35.6%)	14 (51.9%)		31 (38.3%)	9 (47.4%)		28 (36.8%)	12 (50%)		37 (39.4%)	3 (50%)		26 (35.6%)	14 (51.9%)
Two or more	3 (4.1%)	5 (18.5%)	0.006	4 (4.9%)	4 (21.1%)	0.032	3 (3.9%)	5 (20.8%)	0.006	5 (5.3%)	3 (50%)	0.001	3 (4.1%)	5 (18.5%)
Anxiety														
No	58 (79.4%)	19 (70.4%)		63 (77.8%)	14 (73.7%)		61 (80.3%)	16 (66.7%)		73 (77.7%)	4 (66.7%)		58 (79.5%)	19 (70.4%)
Yes	15 (20.6%)	8 (29.6%)	0.423	18 (22.2%)	5 (26.3%)	0.764	15 (19.7%)	8 (33.3%)	0.176	21 (22.3%)	2 (33.3%)	0.619	15 (20.5%)	8 (29.6%)
Depression														
No	64 (87.7%)	18 (66.7%)		71 (87.7%)	11 (57.9%)		65 (85.5%)	17 (70.8%)		79 (84%)	3 (50%)		64 (87.7%)	18 (66.7%)
Yes	9 (12.3%)	9 (33.3%)	0.021	10 (12.3%)	8 (42.1%)	0.006	11 (14.5%)	7 (29.2%)	0.129	15 (16%)	3 (50%)	0.070	9 (12.3%)	9 (33.3%)

Table 5

Comparison of EDI-3 questionnaire scores (reported as mean and standard deviation) between patients with or without suicidality, self-cutting, suicidal ideation, or suicidal attempt (SSRS (dichotomized into 0 vs. ≥ 1) as parameter to evaluate the presence of suicidal behavior, using multivariate analysis of variance (MANOVA).

	Suicidality		Self-cutting				Suicidal Ideation				Suicidal Attempt				Cohen's d		
	No (n = 73)		Yes (n = 27)		No (n = 81)		Yes (n = 19)		No (n = 76)		Yes (n = 24)		No (n = 94)			Yes (n = 6)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		Mean	SD
Single EDI-3 scales																	
Drive for thinness	69.0	28.9	84.6	17.0	69.6	28.5	88.4	10.6	69.8	28.7	84.0	17.6	72.7	27.7	80.2	12.7	69
Bulimia	40.7	32.6	48.8	26.8	40.6	31.8	52.5	27.0	40.9	32.6	49.1	25.8	42.5	31.4	49.0	29.6	40
Body Dissatisfaction	60.8	29.3	74.8	23.5	60.7	29.2	81.1	17.5	61.6	29.0	74.0	24.8	64.3	28.9	68.7	20.7	60
Low self-esteem	55.9	32.0	76.6	26.8	57.3	32.7	79.4	20.6	57.2	32.0	75.2	28.1	61.6	32.0	60.3	34.2	55
Personal alienation	54.6	32.3	75.3	23.7	55.1	32.2	81.7	15.8	55.8	32.3	73.8	24.7	60.0	31.8	62.7	29.8	54
Interpersonal insecurity	62.3	32.5	81.3	20.8	63.4	32.3	84.7	15.5	62.9	32.3	81.6	20.5	67.1	31.4	73.2	23.0	62
Interpersonal alienation	54.2	34.9	71.4	25.1	54.6	34.4	76.6	20.9	55.0	34.6	71.0	25.8	57.2	33.6	83.5	11.3	54
Interoceptive deficits	63.5	28.1	81.6	21.3	65.0	28.3	82.9	18.2	64.5	28.0	80.8	22.5	5.6	27.8	81.2	19.8	63
Emotional dysregulation	54.6	34.0	65.9	28.3	54.6	33.9	70.9	24.4	55.9	33.9	63.3	29.0	58.1	32.9	51.3	33.9	54
Perfectionism	52.2	32.3	51.2	27.8	51.2	31.9	55.1	27.7	51.3	32.4	53.8	26.8	51.8	30.9	54.0	35.3	52
Ascetism	62.3	32.2	72.7	31.0	62.7	32.6	75.5	28.1	61.7	32.1	75.8	30.4	64.6	32.1	72.5	33.4	62
Maturity fears	61.0	29.7	55.1	28.5	60.9	29.6	53.1	28.1	61.0	29.9	54.6	27.6	61.3	28.9	30.5	22.9	61
p-value MANOVA	0.026		0.036				0.111				0.037				0.001		
Composite EDI-3 scales																	
Eating concerns composite	62.5	25.4	76.9	16.4	62.4	24.9	83.3	8.6	63.3	25.2	76.3	17.2	66.3	24.4	67.2	20.2	62
Ineffectiveness composite	58.1	31.6	78.3	23.4	59.4	31.6	81.4	19.2	59.3	31.5	77.2	24.6	63.4	31.1	67.3	29.4	58
Interpersonal problems composite	59.7	34.1	77.9	23.2	61.0	33.5	80.1	22.8	60.4	34.0	77.8	23.1	63.6	33.0	81.0	18.2	59
Affective problems composite	62.1	29.6	80.8	19.7	63.3	29.5	83.7	15.2	63.2	29.5	79.8	20.6	66.7	28.7	74.5	24.3	62
Overcontrol composite	60.4	29.8	68.9	28.5	60.6	29.9	71.6	27.2	59.5	29.8	72.8	27.2	62.4	29.8	66.7	28.5	60
p-value MANOVA	0.025		0.007				0.193				0.702				0.001		