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ORIGINAL ARTICLE

Adolescents with anorexia nervosa with or without non-suicidal self-injury: clinical and psychopathological features

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Abstract

Purpose Anorexia nervosa (AN) and non-suicidal self-injury (NSSI) share typical onset in adolescence, greater prevalence in females and similar risk factors. Nevertheless, clinical features of eating disorders (ED) in this population are still under-investigated, especially associated to psychological features.

Methods The present study aims at comparing clinical and ED characteristics and psychopathological traits in a sample of 253 female adolescents with AN with or without NSSI and to determine possible clinical and psychological predictors on the presence of NSSI. The two groups were compared through multivariate analyses, while correlation and regression analyses were conducted to determine possible associations and predictors.

Results AN + NSSI group showed higher prevalence of binging–purging-type AN ($p < .001$), and mean higher age ($p = .008$) and Body Mass Index (BMI) ($p = .002$) than AN without NSSI group. Concerning psychological scales, AN + NSSI group showed higher scores in mostly of the sub-scale of the test Eating Disorders Inventory-3, higher scores at the scale for depression ($p < 0.001$) and higher scores at the three indexes of Symptom Checklist 90-Revised test, Global Severity Index ($p < 0.001$), Positive Symptoms total ($p = .003$) and Positive Symptom Distress Index ($p < 0.001$). No differences emerged at Children's Global Assessment Scale and at scale for evaluation of alexithymia. Regression analyses showed that a diagnosis of binging–purging-type AN ($p = .001$) predicts NSSI.

Conclusion Results suggest that adolescents with AN and NSSI show peculiar clinical features with higher prevalence of binging–purging-type AN and more severe psychopathological traits than adolescents with AN without NSSI.

Level of evidence Level III: Evidence obtained from cohort or case–control analytic studies.

Keywords Anorexia nervosa · Non-suicidal self-injury · Adolescents · Psychopathology

Introduction

Anorexia nervosa (AN) and non-suicidal self-injury (NSSI) are self-injurious behaviors with common typical onset in adolescence, greater prevalence in females [1] and similar risk factors [2] as family and cultural background, personality traits, perfectionism and obsessive traits [3] and psychological factors, such as childhood trauma, history of sexual abuse, cognitive distortion, low self-esteem and psychiatric disorders [4, 5]. Moreover, empirical evidence and clinical observations suggest a strong link between NSSI and eating disorders (ED). NSSI is reported to occur in 4–18% of the general population, in 14–68% of individuals with AN, and 25–55% of individuals with bulimia nervosa (BN), while 54–61% of people with self-injurious behaviors report current or past ED [6–9]. The high comorbidity and numerous shared risk factors and psychological traits between these disordered behaviors suggest also a similar pathogenesis [10].

In subjects presenting NSSI, eating disorders with more severe symptoms are highlighted, particularly when coexist multiple self-injurious behaviors [11] and a longer treatment history [12]. Furthermore, subjects with both AN and NSSI may display temperament and character features related to borderline personality disorders (BDP) rather than the typical AN profile, or mixed features [13].

In subjects with AN the ability to carry out a lethal self-injury is acquired through tolerance to suffering,

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implemented with multiple and repeated harmful events, such as non-suicidal self-harm, painful compensatory behaviors, stubborn food restriction, different methods for maintaining body weight, dysregulated eating behavior in general [14]. The clinical manifestations of NSSI in AN represent an attempt to regulate and stabilize unmanageable emotional states, to attenuate negative emotions, resolve interpersonal difficulties or punish oneself, acquiring an important coping function for the subject (set of adaptive strategies implemented, more or less consciously, to deal with difficult situations) [15–18].

One of the main characteristics of the psychopathological picture of ED and NSSI is emotional dysregulation: self-injurious acts are used as a tool to deal with affective states, such as anxiety [19, 20], depression [19, 21], worries about one's own body [21]. Patients with ED themselves report that the main reasons that push them to self-harm are to avoid negative feelings and to punish themselves [18, 19, 22]. The etiological model proposed by Svirko [23] highlights common elements between non-suicidal self-harm and eating disorders [24–28], which are briefly treated below:

1. Impulsiveness: common feature of non-suicidal self-harm and anorexia of the type with binges/purging behaviors.
2. Characteristics of obsession–compulsion: they recur in patients with eating disorders and non-suicidal self-harm.
3. Self-harming acts, purging behaviors, self-induced vomiting and severe food restriction are a means of interrupting dissociative events.

Non-suicidal self-harm and eating disorder behaviors are both expressions of feelings of self-punishment, a tendency to self-criticism, low self-esteem, poor consideration of one's body and self-objectification (a tendency to perceive one's body not as an integral part of oneself), which leads to the lack of inhibition of behaviors that could harm the body. Furthermore, both behaviours are used to regulate intrapersonal (i.e., mostly heightened negative affect) and interpersonal (e.g., perceived conflict and negative social appraisals) difficulties in daily life [29, 30].

Claes and colleagues take into consideration another fundamental aspect in the adolescent individual: the formation of identity and the development of the self-suggesting that patients with eating disorder and NSSI present greater identity confusion, difficulty in recognizing what they want, their needs and their inner state of mind than counterpart without NSSI [31]. In a dimensional approach, unstable and intense interpersonal relationships, identity disturbance, impulsivity, emotion dysregulations are symptoms that must be distinguished from typical adolescence by their severity, pervasiveness, and time course and not only by its presence or absence [32].

Finally, impulsiveness, emotion dysregulation and NNSI can also represent symptoms of borderline personality disorders (BPD). In some research, with rates of around 50%, personality disorders are among the most prevalent co-occurring conditions in AN [33] with obsessive–compulsive personality disorder in restricting type AN, while BPD in binging–purging-type anorexia nervosa (BP-AN) [34]. BPD in adolescents is similar to that one in adults for prevalence, symptomatology and course [35] but more often adolescents tend to present with "acute" BPD symptomatology, such as suicidal ideation, impulsive behaviours, and recurrent NSSI. Furthermore, the NSSI/suicidal behaviour's criterion is the most frequently met diagnostic criterion in adolescent BPD samples and actually NSSI are considered a possible precursor of BPD [36]. Despite these evidences, these aspects are still overlooked in research on adolescence also for the debate on usefulness and reliability of personality assessment in adolescence. DSM-5, like DSM-IV, permits diagnosing a PD (other than anti-social PD) in someone under 18 years of age if the symptoms are pervasive, persistent, and have been present for 1 year or longer [37]. Otherwise the association between AN and NSSI has been more explored both among adults and in adolescents, evaluating in general the presence of NSSI in different ED typologies. However, to the best of our knowledge, the particular clinical features of ED in adolescents with AN and NSSI are still to be investigated, especially in conjunction with psychological or psychiatric features. The present study aims i) at comparing clinical and ED characteristics and psychopathological traits in a large cohort of adolescents with AN with or without NSSI; ii) to assess possible association between sociodemographic, clinical and psychological features and the presence of NSSI and possible predictive values of clinical and psychological characteristics on the presence of NSSI.

Materials and methods

This is a single-center, observational and cross-sectional study conducted on a sample of 253 adolescents aged 12–17 years hospitalized at Child and Adolescent mental health Department-ASST Monza, University of Milano-Bicocca (Monza, Italy) from January 2016 to May 2019 for severe malnutrition due to AN (diagnosed according to DSM-5 criteria).

Exclusion criteria were psychotic disorders, other eating disorders, intellectual disabilities and neurological disorders. The presence of personality disorders has not been evaluated since that mean disease duration of the sample is less than 1 year, too short time to diagnose a personality disorder according to DSM-5 [37].

Parents and participants were told the purpose of the study and they gave written informed consent to participate in it. The research was reviewed and approved by the institutional review board of our institution.

Data were collected from patients' medical records and included:

a) sex, age, age at onset of the disorder, information related to the course of AN, including body mass index (BMI) at the time of diagnosis and the last before onset of AN disease (last BMI reported), entity and rapidity of weight loss (delta BMI), duration of disease, presence of amenorrhea, presence of NSSI and/or presence of purging behavior;
b) information related to the family history (psychiatric and eating disorder family history), socioeconomic level according to Hollingshead four-factor index;
c) information related to the individuals' anamnestic history (psychiatric and medical comorbidities).

Psychological profiles were analyzed through self-completed tests:

EDI-3 (Eating Disorders Inventory): a self-report instrument measuring psychological traits relevant in individuals with eating disorders. This test consists of 91 items organized onto 12 primary scales, 3 eating disorder-specific scales and 9 general psychological scales that are highly relevant to, but not specific to, eating disorders. It also yields six composites, one that is eating-disorder-specific (Eating Disorder Risk -EDRC-) and five that tap general integrative psychological constructs (Ineffectiveness -IC-, Interpersonal Problems -IPC-, Affective Problems -AP-, Overcontrol -OC-, and Global Psychological Maladjustment -GPCM-). In this study, we considered only results at 6 composite scales. The reliability coefficients of the scales range from 0.80 to 0.90, and test–retest reliability coefficients for the various composite scales are between 0.93 and 0.98. The EDI-3 provides normative information for females with eating disorders who are aged 13–53 years. In this study, we used the Italian version of the test [38].

TAS-20 (Toronto Alessitimia Scale): a 5-point Likert-type self-report 20-item questionnaire to assess the alexithymia in the total level and three factors: difficulties in identifying feelings (DIF), difficulties in describing feelings (DDF), and lack of focus on internal emotional experiences (EOT). The presence of alexithymia tract is related to a score >61 at the scale. The Italian version of the TAS–20, used in this research, showed good internal consistency (Cronbach's α of .75 and .82 in normal and clinical groups, respectively) and high test–retest reliability over 2 weeks (r = .86). A confirmatory factor analysis revealed the same factor structure as the original English version and adequate internal consistency of the subscales, with α coefficients equal or greater than 0.70 [39].

CDI (Children's Depression Inventory): a self-rating scale widely used to assess depressive symptomatology in children and adolescents aged 8–17 years. All children filled out the Italian version of the test (Cronbach's $\alpha = 0.80$). The test contains 27 items, each consisting of three statements. For each item, the individual had to select the statement that best describes his or her feelings over the past 2 weeks. Every item is scored from zero to two depending on the answer. The total CDI score is the sum of the responses to all 27 items. The CDI uses cut-off scoring: equal to or less than 16 = no depression trait, equal to or greater than 19 = presence of a depression trait. Score of 17 or 18 = border trait [40, 41].

SCL-90R (Symptom Checklist 90-Revised): a self-report questionnaire designed to assess psychological problems and psychopathological symptoms on individuals aged 13 years and older. This original measure and the validated Italian version consist of 90 items rated on a five-point Likert scale that assesses nine-symptom dimensions (somatization [SOM], obsessive–compulsive [OC], interpersonal sensitivity [INT], depression [DEPR], anxiety [ANX], hostility [HOS], phobic anxiety [PHOB], paranoid ideation [PAR], psychoticism [PSY]). The SCL90-R test also provides 3 indexes: General Symptomatic Index (GSI), which discriminates subjects at high risk of psychiatric disorder and in a psychopathological condition; Positive Symptom Total (PST), which corresponds to the number of symptoms checked; Positive Symptom Distress Index (PSDI), a ratio between the sum of all items and the PST. For each index, scores between 55 and 65 are considered borderline, higher than 65 pathological. The Italian version, used in this research, shows good internal coherence for all subscales (α values between 0.70 and 0.96) [42].

The assessment of the global social adjustment of the patients was obtained through the clinician-rated Children's Global Assessment Scale (C-GAS) [43]. The Italian version has been used in previous samples of adolescents with psychiatric morbidities [44]. The scale is separated into 10-point sections that are headed with a description of the level of global functioning and followed by examples matching the given interval. The final score ranges from 1 (the most impaired level of global functioning) to 100 (the superior level of global functioning). The authors report an inter-rater reliability of 0.84, and a test–retest reliability of 0.85.

Statistical analysis

The continuous variables were expressed through mean ± standard deviation of the corresponding distribution; the categorical variables were expressed as absolute

or percentage frequencies. Comparisons for age and BMI across the two groups were performed using analysis of variance for continuous variables. Comparisons for clinical and psychological features in the two groups were conducted through multivariate analyses (MANCOVA) using age and BMI as covariate. Correlation coefficients were used to examine associations between NSSI and socio-demographic, clinical and psychological features. Finally, significant correlations were included in regression analyses as independent variables to evaluate their possible predictive values on the presence of NSSI. Chi-squared or Fisher's exact tests were performed to compare categorical variables. The level of significance was set at $p < 0.05$.

Statistical analysis was performed using the SPSS 26.0 package.

Results

In our study, we included 253 adolescents with Anorexia Nervosa hospitalized in our center (2016–2019) and we analyzed socio-demographic, clinical and psychological features at admittance. We divided our sample into two different groups according to presence or not of NSSI: 40 patients (15,8%) presented NSSI and 213 patients (84,1%) NO-NSSI (Table 1).

The two groups were comparable for gender, psychiatric and ED family history, medical comorbidities, presence of amenorrhea and socio-economic status. The two groups differed for diagnosis with higher prevalence of BP-AN in NSSI group ($X^2 = 16.032(1)$, $p < 0.001$).

The two groups differed for age ($F(1,251)7.12$, $p = 0.008$, ES 0.48) and BMI at admission ($F(1,251)$ 9.74, $p = 0.002$, ES = 0.51) with NSSI group with a mean age and BMI at admission higher than NO-NSSI group.

The MANOVA corrected for age and BMI conducted to evaluate differences in clinical and psychological features in the two groups. (Table 2) showed a significant multivariate effect of Group, $F(14, 107) = 2.048$, $p = 0.021$, $\eta^2 = 2.11$. The two groups did not differ for BMI before illness, Delta BMI and disease duration. Concerning EDI scales, NSSI group showed higher scores in Eating Disorder Risk -EDRC- scale, that means higher risk of ED ($F(14,107) = 12.08$, $p < 0.001$, $\eta^2 = 0.088$), in Ineffectiveness-IC- ($F(14,107) = 14.73$, $p < 0.001$, $\eta^2 = 0.107$), the scale that measures deficit of personal identity, in Affective Problems-APC-($F(14,107) = 6.95$, $p = 0.009$, $\eta^2 = 0.052$), the scale that measures difficulties in both identifying and tolerating mood states, in Over-control-OC- ($F(14,107) = 7.93$, $p = 0.006$, $\eta^2 = 0.058$), that denotes self-defining constructs resistant to change and in Global Psychological Maladjustment- GPMC- ($F(14,107) = 6.53$, $p = 0.012$, $\eta^2 = 0.052$), the scale that measures levels of psychopathology. The two groups differed in CDI scores with higher scores in NSSI groups ($F(14,107) = 17.01$, $p < 0.001$, $\eta^2 = 0.117$). Analysing SCL-90 scales, NSSI group obtained higher scores in Global Severity Index (GSI; $F(14,107) = 15.58$, $p < 0.001$, $\eta^2 = 0.108$), Positive Symptoms total (PST;$F(14,107) = 9.43$, $p = 0.003$, $\eta^2 = 0.070$) and Positive Symptom Distress Index (PSDI;$F(14,107) = 15.58$, $p < 0.001$, $\eta^2 = 0.124$). No differences emerged in CGAS and TAS-20 scores.

Correlation coefficients were used to examine associations between NSSI and socio-demographic, clinical and psychological features outlined significant and positive association between NSSI and BP-AN ($r = 0.173$, $p = 0.010$), amenorrhea, age ($r = 0.166$, $p = 0.008$), last BMI before illness ($r = 0.173$, $p = 0.010$), BMI ($r = 0.194$, $p = 0.002$) and between NSSI and all the EDI-3 composite scales, CDI ($r = 0.183$, $p = 0.010$), TAS $r = 0.319$, $p < 0.001$) and SCL90-R subscales (Table 3). Significant correlations included in regression analyses as independent variables to evaluate their possible predictive values on the presence of NSSI revealed that only a diagnosis of BP-AN (Estimate = 0.220, S.E. = 0.220, $p = 0.012$) predicts NSSI (Table 4).

Discussion

NSSI is a frequent symptom in adolescent subjects with AN, but ED characteristics and psychological profiles are still unclear, especially in adolescence. The first purpose of this study was then to compare clinical and ED characteristics and psychopathological traits in a large sample of adolescents with AN with or without NSSI. To our knowledge, no other studies have been previously conducted on this topic on a large sample of adolescents with AN, considering at the same time both psychological and ED clinical features.

Results confirm, in line with literature, a prevalence of 15.8% of NSSI in patients with AN [6, 7, 23], a mean age higher in NSSI group than for subjects NO-NSSI but anyway in middle adolescence around the age of 14–15 [37], and a prevalence of AN-BP typology in NSSI group [38, 45]. Concerning family history and medical comorbidities, analyses of differences in the two groups showed that a family history for ED or for psychiatric disorders, as the presence of medical comorbidities, is the same. These data, although results in research are still unclear, are in contrast with other studies that described that parental mental disorders have been described as a possible risk factor for NSSI behaviours in adolescents [46]. BMI at admission in NSSI group is significantly higher than NO-NSSI: these data are in contrast with an only published research on a smaller sample of adolescents where no differences in BMI between AN + NSSI and AN without NSSI were described [13], but confirm that NSSI is not associated with severity of AN malnutrition. A possible interpretation of this fact is

Table 1 Sociodemographic characteristics of participants

	AN + NSSI group (*N* = 40)		AN group (*N* = 213)				
	n	%	*n*	%	$X^2(df)$	*p*	
Gender							
Female	39	97.5	205	96.24	0.15(1)	.694	
Male	1	2.5	8	3.75			
Diagnosis							
R-AN	24	60	184	86.4	16.032(1)	< .001**	
BP-AN	16	40	29	13.6			
Psychiatric family history							
No	29	72.5	155	72.76	0.00(1)	.972	
Yes	11	27.5	58	27.23			
ED family history							
No	29	72.5	155	72.76	2.81(1)	.094	
Yes	11	27.5	58	27.23			
Medical comorbidities							
No	39	97.5	199	93.42	1.17(1)	.279	
Yes	1	2.5	14	6.57			
Endocrine conditions	0		4				
Conditions involving malabsorption	1		6				
Metabolic disorders	0		2				
Endocrine + malabsorptio n pathologies	0		1				
Other	0		1				
Amenorrhea							
No	11	27.5	38	1	5.65(2)	.059	
Yes	28	70	167	78.4			
Not pertinent	1	2.5	8	7.5			
Socioeconomic status							
< 19,5	8	20	37	17	0.76	.944	
20 < SES < 29.,5	8	20	47	23	(4)		
30 < SES < 39.,5	8	20	49	24			
40 < SES < 54.,5	12	30	58	27			
> 55	4	10	20	9			
	M	SD	*M*	SD	*F (1,251)*	*p*	*Cohen's d*
Age	15.50	1.41	14.7	1.87	7.12	.008**	0.48
Body Mass Index (BMI)	16.86	2.52	15.63	2.23	9.74	.002**	0.51

R-AN restrictive anorexia nervosa, *BP-AN* binging–purging-type anorexia nervosa, *ED* eating disorders

*$p < .05$. **$p < .01$

that normally a bulimic conduct leads to a less-pronounced weight loss than the restrictive type of AN in ED. Moreover, primary carers become more quickly concerned about the bulimic attitude of their pupils, especially when associated with NSSI. This often leads to earlier hospitalization. Since the two groups differed for age and BMI at admission, analyses of differences in ED characteristics and psychological features between the two groups were conducted considering them as covariates, to exclude their possible influences on clinical and psychological aspects. Regarding to ED characteristics, although the two groups did not show significant differences in clinical features as BMI before illness, delta BMI or disease duration, the NSSI group outlined significantly higher and pathological scores than NO-NSSI group in almost all subscales of EDI-3 test, attesting a more severe psychopathology related to eating disorders even though similar medical conditions. To our knowledge, no previous studies have investigated ED features and ED psychological profiles in subjects with AN and NSSI, both adults and adolescents. Otherwise our results are in line with research conducted on young adults that reported significantly more severe EDI-3 profiles in BP-AN than R-AN under similar

Table 2 Differences in clinical and psychological features in the two groups corrected for age and body mass index

	AN + NSSI group ($N=40$)		AN group ($N=213$)		$F(14,107)$	p	η^2
	M	*SD*	*M*	*SD*			
Last BMI before illness	21.82	3.12	20.25	3.39	.035	.851	.001
Delta BMI at admission	4.71	2.07	4.52	2.84	.035	.851	.001
Disease duration (months)	11.22	10.57	8.92	7.12	1.19	.280	.006
EDI-3							
EDRC	86.43	13.01	62.98	26.88	12.08	< 0.001**	.088
IC	88.83	8.88	66.29	26.88	14.73	< 0.001**	.107
IPC	77.13	21.86	67.46	25.87	2.89	.09	.023
APC	83.35	19.05	66.20	29.05	6.95	.009**	.052
OC	79.43	21.88	60.26	28.29	7.93	.006**	.058
GPMC	83.50	20.33	66.76	27.83	6.53	.012*	.052
CGAS (Children's global assessment scale)	56.09	11.26	57.82	13.02	2.00	.159	.017
TAS-20 (Toronto alexithymia scale)	65.17	10.39	59.53	13.30	2.85	.094	.027
CDI (Children's depression inventory)	26.74	7.01	18.62	8.52	17.01	< 0.001**	.117
SCL-90 R (symptoms check list-90 revised)							
GSI	63.93	11.51	52.99	12.18	15.58	< 0.001**	.108
PST	61.10	10.22	52.22	12.35	9.43	.003**	.070
PSDI	61.46	10.37	51.35	10.31	15.58	< 0.001**	.124

**Corrected for age and BMI

BMI Body Mass Index, *EDRC* Eating Disorder Risk Composite, *IC* Ineffectiveness Composited), *IPC* Interpersonal Problems Composite, *APC* Affective Problems Composite, *OC* Overcontrol Composite, *GPMC* General Psychological Maladjustment Composite, *GSI* Symptoms Check List-90 Revised -Global Severity Index, *PST* symptoms check list-90 revised-positive symptoms total, *PSDI* symptoms check list-90 revised-positive symptom distress index

*$p < .05$; **$p < .01$

medical conditions. [47–49] and with a recent study on adolescents that outlined a greater severity of food obsessive aspects and a significantly more overall food risk elevated in subjects with BP-AN [50].

Analyses of psychological features not strictly correlated to ED symptomatology, revealed no significant differences in TAS-20 scores (a scale for measuring alexithymia) in the two groups, although higher and pathological mean scores in NSSI group, while significant differences were observed in CDI scores and in all the SCL90-R subscales. Findings on alexithymia traits are in contrast with results reported in a systematic review [49] of fifteen studies on relationship in adults between alexithymia and NSSI, which found significantly higher levels of alexithymia in individuals with NSSI compared to individuals without NSSI, especially in females. Our result is also in contrast with a study on adolescents where habitual self-injurers obtained higher levels of alexithymia measured through TAS-20 [51]. We hypothesise that our different results can be due to the fact that both of these studies have been conducted on population without ED, while typically people with ED, especially subjects with AN, show alexithymia traits independently from the presence or absence of NSSI [52, 53]. Higher and pathological levels at scale for depression in the NSSI group agree with results of previous research on adolescents and adults with ED and NSSI. [54, 55], although no specific investigations on adolescents with AN and NSSI are known.

Finally, the NSSI group showed higher and pathological levels of SCL90-R scores, that correspond to higher and major levels of general psychopathology than AN group without NSSI. Although other research using the same test on adolescents with NSSI [51] outlined a major psychopathology than adolescents without NSSI, no studies have been conducted on adolescents with ED and in particular with AN.

The second aim of our study was to study association between socio-demographic, clinical and psychological features and the presence of NSSI and to assess possible predictive values of some features on the presence of NSSI. Analyses revealed associations between the presence of NSSI and socio-demographic and clinical features as a diagnosis of BP-AN, the presence of amenorrhea, higher age at evaluation, higher last BMI before illness and higher BMI at time of evaluation. Furthermore, significant associations emerged between the presence of NSSI and all the psychological scales, both related to ED symptomatology than the ones

Table 3 Correlations between socio-demographic, clinical and psychological features and presence of NSSI

Variables	NSSI
1. Gender Female	–
2. Psychiatric family history	–
3. ED family history	–
4. Medical Comorbidities	–
5. BP-AN	.252**
6. Amenorrhea	−.149*
7. Age	.166**
8. Last BMI before illness	.173**
9. Delta BMI at admission	—
10.Disease duration	—
11.BMI	.194**
12.EDI 3-EDRC	.325**
13.EDI 3-IC	.319**
14.EDI 3-IPC	.209**
15.EDI3-APC	.218**
16.EDI 3-OC	.210**
17.EDI 3-GPMC	.243**
18.C-GAS	–
19.TAS-20	.183
20. CDI	.319**
21. SCL 90-R-GSI	.263**
22. SCL 90-R PST	.204**
23. SCL 90-R PSDI	.283**

BP-AN binging–purging-type anorexia nervosa, *BMI* Body Mass Index, *EDI 3-EDRC* Eating Disorder Risk Composite, *EDI 3-IC* Ineffectiveness Composite, *EDI 3-IPC* Interpersonal Problems Composite, *EDI 3-APC* Affective Problems Composite, *EDI 3-OC* Overcontrol Composite, *EDI 3-GPMC* General Psychological Maladjustment Composite, *TAS* Toronto Alexithymia Scale, *CDI* Children's Depression Inventory, *GSI* Symptoms Check List-90 Revised -Global Severity Index, *PST* Symptoms Check List-90 Revised -Positive Symptoms Total, *PSDI* Symptoms Check List-90 Revised -Positive Symptom Distress Index

*$p < .05$. **$p < .01$

Table 4 Regression analyses entering socio-demographic, clinical and psychological features as independent variables and NSSI as dependent variable

Effect	Estimate	*SE*	95% CI		*p*
			LL	*UL*	
(constant)	−1.177	−1.177	−2.236	−.118	.030
BP-AN	.220	.220	.048	.391	.012
Age	.032	.032	−.021	.085	.240
BMI	.035	.035	−.007	.076	.102
Last BMI before illness	−.003	−.003	−.030	.023	.801
Amenhorrea	.018	.018	−.140	.177	.817
EDRC	.000	.000	−.004	.004	.927
IC	.004	.004	−.002	.010	.155
IPC	−.001	−.001	−.005	.003	.556
APC	.000	.000	−.005	.004	.871
OC	.002	.002	−.002	.006	.391
GPMC	−.003	−.003	−.010	.004	.390
TAS-20	−.002	−.002	−.009	.005	.514
CDI	.009	.009	−.004	.022	.178
GSI	.005	.005	−.010	.020	.533
PST	−.003	−.003	−.015	.009	.595
PSDI	.002	.002	−.011	.015	.760

CI confidence interval, *LL* lower limit, *UL* upper limit, *BP-AN* binging–purging-type anorexia nervosa, *BMI* Body Mass Index, *EDRC* Eating Disorder Risk Composite, *IC* Ineffectiveness Composite, *IPC* Interpersonal Problems Composite, *APC* Affective Problems Composite, *OC* Overcontrol Composite, *GPMC* General Psychological Maladjustment Composite, *TAS* Toronto Alexithymia Scale, *CDI* Children's Depression Inventory, *GSI* Symptoms Check List-90 Revised -Global Severity Index, *PST* Symptoms Check List-90 Revised -Positive Symptoms Total, *PSDI* Symptoms Check List-90 Revised -Positive Symptom Distress Index

*$p < .05$. **$p < .01$

related to depressive and alexithymia symptoms and general psychopathology. Furthermore, regression analyses revealed that a diagnosis of BP-AN predicted the presence of NSSI. Results confirm data of literature on association between BP-AN and NSSI [13, 25, 56, 57] and suggest that the presence of NSSI associated with better medical conditions, differently from other research [11, 13], and with a more severe psychopathology, both related to eating disorders and related to general psychopathology in female adolescents with AN.

In conclusion, our study showed for the first time that adolescents with AN and NSSI show similar or better medical conditions than adolescents with AN without NSSI, but a severe and worst psychopathology both related to the eating disorder, than in terms of general psychological suffering. We believe that our results, if confirmed in further and larger studies, could contribute to improve the comprehension and treatment of AN in adolescence.

Limitations to this study include the lack of a healthy control group and the lack of evaluation of coexistence of personality disorders traits, since that our results seem to be suggestive for the presence at least of borderline traits in adolescents with AN and NSSI.

Conversely, strengths of this study include a large and homogeneous sample of adolescents exclusively with anorexia nervosa, improving the quality of the results and reducing possible bias. Further research should be conducted evaluating the co-presence of a personality disorders, and considering other typologies of eating disorders in adolescence. Other important perspectives for future research include longitudinal studies, to evaluate the presence of NSSI during the course of the illness, and the evolutions of the illness in relation to the presence of NSSI and the possible comorbidity with a personality disorder.

What is already known on this subject?

NSSI is reported to occur in 14%–68% of individuals with AN. AN and NSSI are self-injurious behaviors with onset in adolescence, greater prevalence in females and similar risk factors. The high comorbidity and common risk factors suggest also a similar pathogenesis.

What does your study add?

Our study showed that adolescents with AN and NSSI show similar or better medical conditions than adolescents with AN without NSSI, but severe and worst psychopathology. These findings, if confirmed in larger studies, could contribute to improve the comprehension and treatment of AN in adolescence.

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Declarations

Conflict of Interest Nothing to declare for all the authors.

Ethics approval The present research has been approved by Ethics Committee of ASST Monza and it conforms to the provisions of the Declaration of Helsinki.

Consent to participate Written informed consent was obtained from all individual participants in the present study.

Consent for publication All the authors approved the manuscript content. This manuscript is not under consideration for publication elsewhere and none of the data presented have ever been published elsewhere.

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