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A Multidimensional Approach to Eating Disorders: Exploring the Psychological Mechanisms Associated with Symptom Severity

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SUMMARY (ITALIAN)

I disturbi alimentari sono disturbi mentali severi, associati ad una scarsa qualità di vita, ad un elevato rischio di mortalità e ad un significativo carico economico. Nonostante ciò, la ricerca scientifica in questo ambito rimane ad oggi limitata rispetto a quella condotta in altri settori della salute mentale. Un'area di ricerca che sta emergendo sempre più è quella dell'identificazione dei meccanismi transdiagnostici che sottendono lo sviluppo e il mantenimento dei sintomi alimentari. Tali meccanismi potrebbero rappresentare infatti validi target di trattamento.

Il presente progetto di tesi contribuisce ad indagare il ruolo di specifici meccanismi psicologici nella gravità dei sintomi alimentari e la loro associazione con altre variabili rilevanti, analizzando i dati clinici appartenenti alla banca dati del Centro Regionale per il Trattamento dei Disturbi della Nutrizione e dell'Alimentazione dell'Azienda Ospedaliera Universitaria Integrata di Verona.

I risultati di tre studi clinici empirici hanno evidenziato il coinvolgimento di una varietà di meccanismi psicologici che vanno al di là dei sintomi alimentari osservabili. In particolare, alcuni schemi maladattivi precoci – come l'inadeguatezza (la credenza di essere manchevoli e non amabili), il fallimento (la credenza di essere incapaci di raggiungere i propri obiettivi) e la negatività (credenze pessimistiche riguardo alla vita, con tendenza a minimizzare gli aspetti positivi) – mediano la relazione tra il carico traumatico infantile e la gravità dei sintomi alimentari.

Inoltre, la co-presenza di una difficoltà nel percepire gli stati corporei interni (deficit interocettivo clinico) e del ricordo di commenti sull'aspetto fisico ricevuti prima dell'esordio del disturbo alimentare è associata a una maggiore gravità di sintomi alimentari di natura restrittiva e ad altri fattori, quali l'ascetismo e la disregolazione emotiva.

Infine, all'interno di un campione di pazienti con disturbi alimentari sono state individuate diverse configurazioni affettive, ognuna delle quali associata a specifiche caratteristiche cliniche, come la durata della malattia, la gravità dei

sintomi alimentari, la psicopatologia generale e il carico traumatico. Questi risultati evidenziano un'ampia eterogeneità dei profili affettivi tra i pazienti con disturbi alimentari, suggerendo la necessità di approcci terapeutici personalizzati.
In generale, l'identificazione di questi meccanismi psicologici può rappresentare un passo significativo verso la personalizzazione delle cure, un paradigma emergente che si pone l'obiettivo di superare i modelli di trattamento standardizzati, migliorando l'accuratezza diagnostica, il processo decisionale clinico personalizzato e gli esiti di trattamento e prognosi per le persone affette da disturbi alimentari.

ABSTRACT

Eating Disorders (EDs) are severe mental disorders associated with low quality of life, elevated mortality risk, and high financial burden. Nonetheless, research in this field remains limited compared to other psychiatric disorders. One research area that is increasingly emerging is the detection of key mechanisms that underlie the development and maintenance of ED symptoms, as these mechanisms may represent valuable targets of treatment (Obeid et al., 2025).

By analyzing clinical data extracted from the Regional Centre for Feeding and Eating Disorders registry (University Hospital of Verona), this thesis contributes to investigating the role of specific psychological mechanisms in the severity of ED symptoms and their association with other relevant variables. Findings from three clinical empirical studies highlighted the involvement of psychological mechanisms that extend beyond the observable ED symptoms. Particularly, some early maladaptive schemas, such as defectiveness (i.e., belief about oneself as defective and unlovable), failure (i.e., belief about oneself as incapable of achieving goals), and negativity (i.e., negative beliefs about life, minimizing positive aspects), mediated the relationship between childhood trauma burden and the severity of ED symptoms.

Moreover, it has been shown that the simultaneous co-occurrence of difficulties in perceiving bodily internal states (i.e., clinical interoceptive deficits) and the recollection of appearance-related comments received prior to the ED onset was associated with greater restrictive eating symptoms and other factors, such as asceticism and emotion dysregulation.

Lastly, distinct affective patterns have been found within a sample of ED outpatients, each of them associated with specific clinical characteristics such as duration of illness, eating symptom severity, general psychopathology, and trauma burden. These findings point a heterogeneity of emotional profiles among ED patients, suggesting the need for more tailored therapeutic approaches.

Overall, the identification of these psychological mechanisms may represent a step toward the advancement of personalization of care - a paradigm that aims to move beyond one-size-fits-all treatment models by improving the diagnostic

accuracy, personalized clinical decision-making, and treatment outcomes and prognosis for individuals affected by EDs.

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1. BACKGROUND

1.1. Eating Disorders: Clinical Definitions and Core Characteristics

Eating Disorders (EDs) are severe mental health conditions characterized by significant disturbances in eating and eating-related behaviors, which negatively affect physical health, social functioning, and quality of life (APA, 2022). They are associated with elevated mortality risk and substantial economic burden (van Hoeken et al., 2020; Ahmed et al., 2025). The lifetime ED prevalence is estimated to be about 2–5% (Attia & Walsh, 2025). Although these disorders are more commonly diagnosed in females (Solmi et al., 2024), recent research indicates that eating symptoms are also present in the male population (Raevuori et al., 2014). In recent years, the global incidence of EDs has increased, particularly among children and adolescents, with a notable decrease in the mean age of onset (Pastore et al., 2023; Solmi et al., 2024; Favaro et al., 2018). Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) (APA, 2022) describes the following three diagnostic categories within EDs: (1) Anorexia Nervosa (AN) is marked by food restriction that leads a significantly low body weight in the context of age, sex, developmental trajectory, and physical health; heightened fear of gaining weight or of becoming fat, or persistent behavior that impedes weight gain; alteration in the way in which one's body weight or shape is experienced, excessive influence of weight or body shape on self-evaluation, or lack of recognition of the physical condition's severity. In the restricting subtype of AN, weight loss is accomplished primarily through dieting, fasting, and/or excessive exercise, whereas in the binge-eating/purging subtype of AN the individual engages in recurrent episodes of binge-eating or purging behaviors (i.e., self-induced vomiting or the misuse of diuretics, laxatives, or enemas). The severity level is based on Body Mass Index (BMI) or BMI percentile, respectively, for adults and children/adolescents. A BMI range between 15-15.99 15 kg/m^2 indicates severe AN, whereas a BMI lower than 15 kg/m^2 indicates an extreme severity of AN. (2) Bulimia Nervosa (BN) is characterized by recurrent episodes of binge eating, defined as follows: eating, in a discrete period of time, an amount of food that is definitely larger than what

most individuals would eat; a sense of lack of control over eating during the episode; recurrent inappropriate compensatory behaviors to prevent weight gain (e.g., self-induced vomiting; misuse of laxatives, diuretics, or other medications, fasting or excessive exercise); the binge eating episodes and inappropriate compensatory behaviors both occur, on average, at least once a week for 3 months. Self-worth is significantly influenced by body shape and weight. The disorder does not exhibit exclusively during AN episodes. The severity level is based on the frequency of inappropriate compensatory behaviors. A severe level of BN is indicated by an average of 8–13 episodes of inappropriate compensatory behaviors per week, whereas an extreme level of BN is indicated by an average of 14 episodes (or more) of compensatory behaviors per week. (3) Binge Eating Disorder (BED) is characterized by recurrent episodes of binge eating not associated with the habitual use of compensatory behaviors. The severity level is based on the frequency of episodes of binge eating. 8–13 binge-eating episodes per week indicate a severe level, whereas an extreme level is marked by 14 or more binge-eating episodes per week.

DSM-5-TR also describes Feeding Disorders (FDs) such as Pica, characterized by a persistent eating of nonnutritive, nonfood substances over a period of at least 1 month; Rumination Disorder, characterized by repeated regurgitation of food over a period of at least 1 month (regurgitated food may be rechewed, reswallowed, or spit out); and Avoidant/Restrictive Food Intake Disorder (ARFID), characterized by an apparent lack of interest in eating or food, avoidance based on the sensory characteristics of food, or concerns about aversive consequences of eating, associated with significant weight loss or significant nutritional deficits or dependence on oral nutritional supplements or enteral feeding. There is the absence of the disturbance related to the weight and body shape's experience.

Other two diagnostic categories were described by DSM-5-TR, both characterized by the unsatisfaction of full criteria for the abovementioned disorders: Unspecified Feeding or Eating Disorder (UFED), in which eating symptoms cause clinically significant distress but they do not meet the full criteria for the abovementioned disorders because there is insufficient information to make a more specific diagnosis (e.g., in emergency room); Other Specified Feeding or

Eating Disorder (OSFED), in which eating symptoms cause clinically significant distress but they do not meet the full criteria for any of the abovementioned disorders for specific reasons: all of the criteria for AN are met, except the individual's weight that is within or above the normal range (i.e., atypical AN); all of the criteria for BN are met, except that the binge eating and inappropriate compensatory behaviors occur, on average, less than once a week and/or for less than 3 months (i.e., subthreshold BN); all of the criteria for BED are met, except that the binge eating occurs, on average, less than once a week and/or for less than 3 months (i.e., sub-threshold BED); recurrent purging behavior to influence weight or shape in the absence of binge eating (i.e., purging disorder); repeated episodes of night eating, characterized by eating after wakening from sleep or by excessive food consumption after the evening meal (i.e., night eating syndrome).

1.2 Eating Disorders as Multifactorial Disorders: Insights into the Main Factors Involved in Onset and Maintenance

The development and maintenance of EDs result from a complex interaction of biological, genetic, psychological, and socio-environmental factors (Frank, 2016).
From a biological perspective, research has pointed out alterations in various systems regulating feeding and eating behaviors, including peripheral appetite-regulating signals and their interactions with higher-order brain circuits involved in the cognition and emotional regulation (Foldi & Griffiths, 2025; Mancuso et al., 2020; Seidel et al., 2021). Recent studies have widened the biological framework by underlining the role of the enteric nervous system and the disruption of the brain–gut axis in both the onset and maintenance of the ED psychopathology (Foldi & Griffiths, 2025; Reed et al., 2021; Sudo et al., 2021).
On the genetic level, polymorphisms across various neurotransmitter systems have been identified (Trace et al., 2013), as well as genetic variants associated with low body mass index (BMI), reduced fat percentage, and metabolic conditions such as type 1 diabetes. In particular, these traits are particularly common among AN patients (Bulik-Sullivan et al., 2015; Duncan et al., 2017; Yilmaz et al., 2018; Hubel et al., 2019), underscoring the crucial role of metabolic and anthropometric traits in the development of ED. Because of this, some authors have proposed re-thinking AN as a metabo-psychiatric disorder (Bulik et al., 2021; Watson et al., 2019).
Moreover, alterations in the brain's reward pathways (i.e., dopaminergic system) have been linked to the ED pathophysiology and may hinder the recovery process (Foldi & Griffiths, 2025). These circuits are particularly responsive to changes in food intake: food restriction tends to sensitize the dopamine system, whereas overeating leads to its desensitization. Puberty, through estrogen actions, can also influence the dopaminergic system. These neurobiological changes may trigger disordered eating behaviors and contribute to the illness's maintenance (Frank et al., 2016).
Additionally, stress plays a unique neurobiological role in the onset and maintenance of EDs. Stressful life events may activate epigenetic mechanisms

that, depending on genetic predisposition, lead individuals into cycles of food under- or over-consumption. These behaviors may initially be positively reinforced—weight loss in AN or mood improvement in BED - increasing the likelihood of perpetuated dietary restriction or binge episodes. Over time, these patterns may result in undernourishment in AN patients or compulsive overeating in BED patients. Moreover, starvation itself can trigger epigenetic cascades that reinforce habit formation and maintenance of ED behaviors (Guarda et al., 2015). Therefore, dieting or binge eating behaviors can be used as maladaptive strategies to cope with negative emotions, acting as negative reinforcement (Foldi & Griffiths, 2025). Stressful events often include bereavement, family separation, dysfunctional family dynamics, low self-esteem, or social pressures - factors particularly relevant during adolescence, a critical period for the ED onset (Barakat et al., 2023; Frank et al., 2016).

Exposure to trauma has been widely associated with EDs. Trauma-related ED presentations are often marked by more severe ED symptoms, greater psychiatric comorbidity, dysfunctional relational patterns, and higher neurobiological, emotional, and behavioral dysregulation (Moroshko et al., 2025; Giokatos, 2020). Furthermore, traumatized individuals with EDs often show altered responses to treatment, which can hinder recovery from the illness (Moroshko et al., 2025).

In accordance with a recent systematic review conducted by Moroshko and colleagues (2025), several models have been proposed to explain the role of trauma in the ED development. The gene-environment interaction model supports that a pre-existing genetic vulnerability interacts with a trauma burden, exceeding the individual's coping capacity and increasing the risk for psychopathology. Other authors highlight that it is not the traumatic event itself, but rather its negative consequences - such as physiological, affective, cognitive, and social ones - that are more directly associated with the ED onset (Moroshko et al., 2025). In line with this perspective, some researchers argue that individuals with a trauma history may engage in ED behaviors as a way of dissociation or self-medication to manage trauma-related arousal (Longo et al., 2021; Brewerton, 2011).

Beyond biological and genetic perspectives, social and cultural factors significantly contribute to the ED onset.

Historically, EDs have been considered 'Western culture-bound syndromes', although increasing prevalence in non-Western countries suggests a broader cultural impact. Culture exerts a pathoplastic effect, influencing the clinical presentation of mental disorders. In Western societies, the thin beauty ideal has been widely considered as an ED risk factor, particularly when it is spread through traditional and social media, such as pro-AN or pro-ED websites (Barakat et al., 2023).

High ED rates have also been reported among athletes. Literature has described the female athlete triad (i.e., low energy availability, amenorrhea, and low bone mineral density), subsequently renamed 'Relative Energy Deficiency in Sport' (RED-S) syndrome (Mountjoy et al., 2014), which often stems from excessive physical activity or disordered eating aimed at achieving a lean body (Barakat et al., 2023; Wheatley et al., 2012).

One of the most prominent sociocultural theories is the objectification theory (Fredrickson & Roberts, 1997), which posits that cultural contexts objectifying the female body increase the ED risk through mechanisms such as self-objectification, thin ideal internalization, body surveillance, and body shame (Weissman, 2019).

Others sociocultural risk factors are being female (although gender ratios vary across diagnoses, with BED showing the smallest gender difference), white ancestry, higher parental socioeconomic status, and immigrant status. Family and peer pressure related to appearance, as well as receiving comments by the social context regarding weight, body shape or eating, can contribute to the ED risk, together with other predisposing factors (Weissman, 2019; Varnagirytė et al., 2021; Dahill et al., 2021).

Family dynamics play a central role in the development and maintenance of EDs. The risk increases if parents have an own history of EDs, engage in disordered eating, or exhibit traits such as perfectionism. Furthermore, low emotional connectedness within the family, poor communication, and lack of parental warmth have all been associated with increased ED risk (Barakat et al., 2023).

Attachment styles and emotion regulation within the family system are also pivotal. Insecure attachment style (i.e., anxiety/preoccupied or avoidant/dismissing) has been related to greater ED symptoms across diagnoses (Abbate-Daga et al., 2010), and this relationship seemed to be mediated by other mechanisms such as perfectionism and dysfunctional regulation of emotions (Tasca et al., 2019).

Moreover, the cognitive-interpersonal maintenance model (Schmidt & Treasure, 2006; Treasure et al., 2020) describes that family members may adapt to the patient's ED symptoms, such as to accommodate restrictive eating rules or ignore the negative consequences of ED behaviors, thereby contributing to the disorder's maintenance (Treasure et al., 2020).

Family members can also be viewed as a significant resource. In fact, evidence-based interventions - such as *Family-Based Treatment* (FBT) - actively involve parents as central agents of change, particularly in adolescent populations. In these approaches, the focus is on empowering families to support nutritional rehabilitation and disrupt disordered patterns (Rienecke, 2017).

1.3. Some Recent Psychological Theories Attracting Interest in the Field of Eating Disorders

Numerous efforts have been made to identify the psychological mechanisms underlying the development and maintenance of EDs. The transdiagnostic cognitive-behavioral theory (Fairburn, Cooper, & Cooper, 1986) identifies a dysfunctional system of self-evaluation as the core mechanism of EDs. According to this model, ED individuals' self-worth is largely based on their eating habits, body shape, weight, and their perceived ability to control these aspects. This self-evaluation system gives rise to intense concerns about weight, shape, and food, which impair concentration and lead to extreme weight-control behaviors such as dietary restraint, self-induced vomiting, misuse of laxatives or diuretics, excessive exercise, body checking, or body avoidance. The failure to meet the high standards regarding weight, shape, and eating leads to secondary negative self-evaluation, which in turn perpetuates a vicious cycle. In an attempt to restore self-worth, individuals tried to control eating, weight, and shape, thereby maintaining the disorder (Fairburn, Cooper, & Cooper, 1986; DuBois et al., 2017). This model was subsequently expanded to include other psychological mechanisms that contribute to the disorder's perpetuation and act as barriers to change. These include clinical perfectionism, core low self-esteem, mood intolerance, and interpersonal difficulties.

Clinical perfectionism refers to a self-evaluation system based on meeting demanding standards. When these high standards are applied to eating, weight, and shape, they can significantly interfere with ED recovery (Fairburn, Cooper & Shafran, 2003; Egan et al., 2011). In adolescent populations, perfectionism has been shown to be indirectly associated with ED symptoms through its effects on self-esteem and mood intolerance (Favaro, 2021; Jones et al., 2020).

Core low self-esteem concerns a pervasive negative view of oneself. This contributes to hopelessness about the capacity for change, impairs the treatment compliance, and pushes the individual to reach self-worth through control of eating, weight, and shape. Patients with core low self-esteem often show negative cognitive biases, interpreting failures as confirmation of their perceived

inadequacy. This mechanism has been associated with poorer treatment outcomes (Krauss et al., 2023; Fairburn, Cooper & Shafran, 2003).

Mood intolerance refers to the inability to tolerate certain emotional states, such as anxiety, anger, or sadness, as well as excitement. In response, individuals may engage in maladaptive mood modulation behaviors, including self-injury or substance use. Over-exercising, binge eating, and self-induced vomiting can also serve as habitual emotion regulation strategies (Fairburn, Cooper & Shafran, 2003; Mallorquí-Bagué et al., 2017). Further research on AN has shown that even dietary restriction may serve as a dysfunctional emotional regulation strategy by reducing unpleasant emotions in the short term (Haynos & Fruzzetti, 2011).

Interpersonal difficulties also play a crucial role in ED maintenance. Negative interpersonal events often precipitate binge-eating episodes, and long-term relational difficulties can undermine self-esteem and negatively influence treatment outcomes (Fairburn, Cooper & Shafran, 2003; Jones et al., 2015). The cognitive-interpersonal maintenance model, developed by Treasure and colleagues (Schmidt & Treasure, 2006; Treasure et al., 2013; Treasure et al., 2020) further investigated the factors involved in the development and maintenance of EDs, particularly AN. This model underlines the role of both cognitive and emotional processes in perpetuating the disorder over time. Individuals with AN often display a cognitive style marked by low cognitive flexibility – particularly difficulties with set-shifting. Additionally, they tend to show an imbalance between global and detail-focused information processing, with a strong preference for detail-oriented thinking, a trait known as weak central coherence. These cognitive features are further amplified by the consequences of starvation, which in turn can hinder the ability to respond flexibly to the environmental demands, thereby contributing to the ED persistence.

In addition, the model highlights a particular interpersonal and emotional style marked by the tendency to avoid emotional experiences, especially those occurring in social contexts. Individuals often exhibit emotional inhibition and a diminished capacity for emotional mirroring (i.e., they may struggle to reflect or respond to the others' emotional states). These emotional and interpersonal difficulties can lead to dysfunctional social interactions and further reinforce the

maintenance of the ED (Treasure et al., 2013; Treasure et al., 2020). Additionally, emerging research on schema therapy suggests that ED individuals may be characterized by early maladaptive schemas (EMS) - pervasive and dysfunctional beliefs about the self, others, and the world - rooted in unmet emotional needs during childhood. These schemas may predispose individuals to interpersonal difficulties and emotional dysregulation, thereby reinforcing dysfunctional coping strategies. Hence, EMS contribute to both the onset and maintenance of ED psychopathology (Maher et al., 2022; Pugh, 2015).

Another critical dimension in understanding EDs, particularly AN, involves disturbances in body experience. AN has been conceptualized as a disorder of embodiment - pertaining to the way individuals experience their own bodies. A key distinction in this context is between the 'subject-body' and the 'object-body'. The subject-body refers to the immediate, first-person, lived experience of the body as an agent within the world; it is the basis for self-awareness. In contrast, the 'object-body' is the body seen as 'an object' and evaluated from an external, third-person perspective, often shaped by visual perception (i.e., looking at the mirror) and social feedback (Stanghellini, 2019). Clinical and cognitive neuroscientific research has increasingly indicated that individuals with ED tend to over-rely on the objectified, third-person negative view of their bodies, which cannot be changed and updated by the subjective experience of the body (i.e., first-person perspective), even after significant weight loss. This imbalance between third-person/objectified and first-person/subjective perspectives of the body may play a central role in body image distortions and ED psychopathology (Stanghellini, Ballerini & Mancini, 2019; Riva, 2014; Riva, 2012). The role of body experience has also been described by the psychodynamic model, originally developed by Hilde Bruch (1973) and subsequently revised (Skårderud, 2009). It conceives severe eating disorders as self-disorders, resulting from developmental deficits in the organization of the self. These deficits are expressed in terms of inaccuracy in perceiving and interpreting one's own bodily stimuli such as hunger and satiety, as well as fatigue and weakness as signs of malnutrition (i.e., interoceptive confusion). Therefore, the body experience is 'mis-categorised' (Skårderud, 2009). Moreover, ED patients reported alexithymia, a concept that

refers to the disconnection between physiological and subjective aspects of emotions; thus, they experience difficulty in identifying and describing emotional states. The lack of awareness of internal states and the inability to rely on them to guide behavior can contribute to a sense of ineffectiveness. Then, ED symptoms represent a way to compensate for these deficits and to maintain the cohesion and stability of the sense of self (Skårderud, 2009). These developmental vulnerabilities are rooted in unmet attachment needs, particularly the lack of adequate attunement and mirroring between the child's internal states and the caregiver's responses (Tasca & Balfour, 2015; Skårderud, 2009). Within this context, as underlined by Skårderud (2009), ED patients exhibit impaired mentalization, defined as the capacity to understand others' mental states, one's own mind, and one's own body (Robinson, Skårderud & Sommerfeldt, 2019).

Taken together, these models discussed the multifaceted nature of EDs. Rather than being driven solely by concerns about weight or food, EDs emerge and persist through the complex interplay of cognitive inflexibility, dysfunctional emotional regulation, interpersonal difficulties, and disturbances in self-concept and embodiment.

2. OBJECTIVES OF THE THESIS

2.1. Aims of the thesis

Despite the increasing efforts over recent decades to identify the factors involved in the onset and maintenance of EDs, research in this field remains limited when compared to other major mental health conditions, such as mood disorders, psychosis, or neurodevelopmental disorders (Marzola et al., 2022; Solmi et al., 2022). Several factors may account for this gap.

First, research funding for EDs remains disproportionately low compared to other psychiatric conditions. Moreover, EDs are often excluded from large-scale mental health research initiatives (e.g., the Wellcome Trust Mental Health Funding program), reflecting a broader marginalization of EDs within the mental health research community. Many researchers and clinicians tend to view EDs as a 'niche speciality' within psychiatry rather than as an integral component of the broader mental health field (Marzola et al., 2022; Solmi et al., 2022). This marginalization is partly rooted in the unique nature of EDs - particularly AN - which distinguish them from most other psychiatric disorders due to their dual mind–body dimension. Individuals with EDs present both severe mental illness and severe physical complications that interact with one another (Philippou et al., 2025). This dual implication represents a distinctive challenge for national health systems, as patients often fall between medical and psychiatric care. Consequently, this issue has fostered an overspecialization and siloing of ED research and clinical practice from the broader psychiatric field (Philippou et al., 2025; Haynos et al., 2024).

Such siloing and the resulting lack of interdisciplinary collaboration have slowed the integration of novel concepts and methodologies that have become well-known in other mental health research areas (Philippou et al., 2025). Consequently, there remains a lack of understanding regarding the key processes and mechanisms that underlie the onset and maintenance of EDs, as well as those that influence clinical improvement and recovery (Philippou et al., 2025; Jansen, 2016).

Addressing this gap requires research that investigates mechanistic knowledge, with the aim of pinpointing the targets and mechanisms of change that can inform more effective and personalized interventions (Monteleone & Abbate-Daga, 2024). Promoting such mechanism-focused research is essential for advancing scientific progress and clinical practice of EDs (Philippou et al., 2025).

From these premises, the present thesis aimed to contribute to the investigation of specific key mechanisms - early maladaptive schemas, body experience-related factors, and emotional functioning - that remain relatively underexplored in the field of EDs, and that may be involved in the severity of ED symptoms.

The present work considered these mechanisms in relation to other aspects relevant to the ED psychopathology. Specifically, the investigation of early maladaptive schemas was framed within the theoretical perspective of Schema Therapy and took into account trauma-related factors; the study of emotional functioning was informed by Panksepp's affective neuroscience model, with particular attention to the concurrent activation of multiple primary emotional systems, whereas the examination of body experience was grounded in the theoretical framework of the Allocentric Lock Theory, taking into account its multidimensional nature, which is shaped by aspects such as interoceptive deficits and the recollection of appearance-related comments from others.

Through this approach, the present work aimed to deepen the understanding of the role and relevance of these mechanisms in the severity of ED psychopathology.

Table A. Overview of the psychological mechanisms, theoretical models, and studies' aims

	STUDY 1	STUDY 2	STUDY 3
Psychological mechanisms	Early Maladaptive Schemas	Body experience-related factors	Primary emotional systems
Theoretical framework	Schema Therapy model (Young, 2003)	Allocentric Lock Theory (Riva, 2012)	Panksepp's Affective Neuroscience model (Panksepp, 2006)
Specific aims of the study	(1) compare ED symptom severity and early maladaptive schemas (EMS) of patients with severe childhood trauma to those with no/mild childhood trauma; (2) investigate the mediating role of EMSs on the relationship between childhood trauma and ED symptom severity.	(1) to examine the frequency of self-reported comments regarding eating habits, appearance, and one's own person received by others; (2) to investigate if the ED severity was associated with the self-reported onset of appearance-related comments, the degree of interoceptive deficit, and the interpersonal sensitivity; (3) to explore psychopathological features of ED patients presenting both clinically significant interoceptive deficit and self-reported appearance-related comments received prior to ED onset, in comparison to those presenting only one of these factors or neither of them.	(1) to identify distinct empirically derived profiles of primary emotional systems; (2) to explore differences between these profiles in terms of socio-demographic variables and clinical variables; (3) to examine the association between profile membership and clinical variables.

2.2. BAN.DA. DCA project: The Regional Centre for Feeding and Eating Disorders Registry

The investigation of the abovementioned key psychological mechanisms related to ED psychopathology (see 2.1. *Aims of the Thesis*) was conducted using data from the Regional Centre for Feeding and Eating Disorders Registry at the University Hospital of Verona. The registry was approved by the Local Ethics Committee in 2022, and it aims to systematize data from ED outpatients who have sought care at the Regional Centre since 2014. This registry contains socio-demographic and clinical information routinely collected during the first psychodiagnostic assessment of outpatients seeking treatment at the Centre, during the post-treatment assessment, and during the follow-up at six months after the treatment ends. The Regional Centre for Feeding and Eating Disorders is a tertiary care level specialized service. Unlike other psychiatric facilities, admission is not restricted by catchment area criteria, so all individuals residing in Italy may potentially access it when an ED is suspected. Due to geographical proximity, the majority of patients reside in the Verona area. As a result, the registry mainly provides a representative overview of ED outpatients from the Verona area.

The main objectives of the registry are to:

•Describe the characteristics of outpatients who seek care at the Centre;

•Monitor longitudinally the patients' symptom trajectories;

•Analyze features associated with ED symptoms and other psychopathological dimensions;

•Utilize these data to identify and develop more appropriate and personalized interventions for patients.

According to these aims, the registry includes sociodemographic data (e.g., sex, age, educational level, occupational status, and marital status), anthropometric data (e.g., BMI, premorbid weight, etc.); clinical characteristics of the disorder (e.g., ED diagnosis subtype; age of the ED onset, ED severity, ED symptoms, risk factors, and psychosocial impairment related to the ED); general psychopathology

(e.g., depressive, anxiety, and somatization, obsessive-compulsive symptoms, phobic anxiety, hostility, paranoid ideation, psychoticism, dissociative symptoms); adverse experiences during childhood, other traumatic events, and the subjective impact of these experiences; other relevant psychological features (e.g., early maladaptive schemas, alexithymia, impulsivity, etc.); and family psychiatric history. Data were collected through clinical interviews, semi-structured clinical interviews, and self-report measures to capture both the clinician's and the patient's perspectives.

Over time, new types of data - collected through specific self-report instruments - have been added to the registry, including measures of primary emotional systems, personality traits, and the recollection of appearance-, eating-, and person-related comments received from others, given their potential relevance for the field of EDs.

Overall, the registry represents a valuable resource for the systematic collection of clinical data on cohorts of patients with EDs, supporting both clinical monitoring and research activities.

The 'Banca Dati DCA' (BAN.DA. DCA) project represents a small-scale initiative for the systematic routine clinical data collection within the Italian context, consistent with recent international calls by researchers advocating for the implementation of routine clinical outcome measurements in ED services. At the international level, three major frameworks have been proposed to promote large-scale, routine collection of clinical outcomes in ED services: the *International Consortium for Health Outcomes Measurement (ICHOM) eating disorder set* (Austin et al., 2023), the *Australia national minimum dataset* (Bryant et al., 2023), and the *Eating Disorders Clinical Research Network* (Allen et al., 2024). These projects aim to promote systematic, standardized data collection and analysis both within and across ED services, considering multiple data domains, such as demographic characteristics, cognitive functioning, co-occurring mental health conditions (e.g., suicidality), physical health indices, ED-related clinical features, comorbidities, quality of life, social functioning, and treatment-related information (Austin & Allen, 2025). Moreover, Obeid and colleagues (2025) conceptualized a precision ED data and bio-registry, named '*Eating Disorder Bio-*

Registry and Multiaxial Precision Health Platform' (EDBioMAP), which integrates clinical and psychosocial data with biomarker-derived data, accounting for the multi-dimensional nature of EDs.

The systematic data collection has been recommended to improve diagnostic accuracy and clinical outcomes, monitor symptom trajectories, and identify patients who may not respond adequately to treatment, consistently with the precision medicine approach (Austin & Allen, 2025; Obeid et al., 2025).

3. EMPIRICAL CONTRIBUTIONS

3.1. STUDY 1: Early maladaptive schemas mediate the relationship between severe childhood trauma and eating disorder symptoms: evidence from an exploratory study (Fasolato, De Felice, Barbui et al., (2024). *Journal of Eating Disorders*)

Fasolato et al. Journal of Eating Disorders (2024) 12:138
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Early maladaptive schemas mediate the relationship between severe childhood trauma and eating disorder symptoms: evidence from an exploratory study

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Abstract

Background Childhood trauma history has frequently been linked to eating disorders (EDs); nevertheless, the scientific literature calls for extending knowledge regarding mediators between EDs and childhood trauma. This study explored whether ED symptoms and early maladaptive schemas were more severe in ED patients with severe childhood trauma than in ED patients with no/mild childhood trauma and whether early maladaptive schemas mediated the relationship between childhood trauma and ED symptom severity.

Methods Data were extracted from the Regional Centre for Eating Disorders registry at the University Hospital of Verona. The extracted data included self-reported data, including the Eating Disorder Inventory-3 score, Young Schema Questionnaire score, Childhood Experience and Experience of Care and Abuse Questionnaire score, and sociodemographic and clinical information on the ED outpatients seeking care. A mediation analysis using the structural equation modeling procedure was conducted.

Results Forty-two outpatients, 31% of whom exhibited severe childhood trauma, satisfied the criteria for registry data extraction. The severity of ED symptoms, as well as the early maladaptive schemas' scores for emotional deprivation, defectiveness, failure, vulnerability, insufficient self-control, and negativity, were greater in ED outpatients with severe childhood trauma. Furthermore, early maladaptive schemas related to defectiveness, failure, and negativity had a mediating role in the relationship between severe childhood trauma and ED symptom severity.

Conclusions This exploratory study provides preliminary evidence about the importance of early maladaptive schemas in the relationship between trauma history and ED psychopathology. In addition, ED symptoms may represent a dysfunctional attempt to avoid unpleasant emotions associated with schema activation. The results support the need to consider early maladaptive schemas in the treatment of traumatized patients with ED symptoms. Study limitations, research and clinical implications are discussed.

Keywords Eating disorders, Childhood trauma, Early maladaptive schemas, Outpatients, Psychopathology

3.1.1. Introduction of study 1

Eating disorders (EDs) are disabling, fatal, and costly mental disorders that severely affect physical health and disrupt psychosocial functioning (Van Hoeken & Hoek, 2020). The Diagnostic and Statistical Manual of Mental Disorders, fifth edition, Text Revision (DSM-5-TR) categorizes EDs into the following broad categories: anorexia nervosa (AN) - two subtypes: restricting AN (AN-R) and binge-purging AN (AN-BP) - bulimia nervosa (BN), binge eating disorder (BED), and avoidant/restrictive food intake disorder (ARFID), with other specified feeding or eating disorders (OSFED) and unspecified feeding or eating disorders (UFED) as additional categories (American Psychiatric Association, 2022). The ED incidence has increased globally, from 3% in 2000-2006 to 8% in 2013-2018 (Galmiche et al., 2019). Since the COVID-19 outbreak, ED rates have continued to rise, as indicated by the increasing incidence of ED diagnoses, primarily in young people (Taquet et al., 2022). Moreover, a considerable number of patients persist in having ED symptoms at long-term follow-up, affecting the health and quality of life of patients and their caregivers (Van Hoeken & Hoek, 2020).

A complex interplay between psychosocial and biological factors sustains the development and maintenance of EDs (Frank, 2016). Several studies have reported an increased likelihood of trauma in ED patients (Rienecke et al., 2022; Trottier & MacDonald, 2017; Caslini et al., 2016), with a lifetime incidence ranging from 21% to 67% (Kjaersdam Telléus, Lauritsen & Rodringo-Domingo, 2021; Molendijk et al., 2017). Specifically, sexual trauma remains the most well-documented symptom in this clinical population, with a lifetime prevalence ranging from 6% to 64% (Convertino, Morland & Blashill, 2022; Madowitz, Matheson & Liang, 2015; Backholm, Isomaa & Birgegard, 2013). Furthermore, physical and emotional abuse (Afifi et al., 2017; Fischer, Stojek & Hartzell, 2010), emotional and physical neglect (Kimber et al., 2017; Piacentino et al., 2016; Pignatelli et al., 2017), teasing, bullying (Kjaersdam Telléus, Lauritsen & Rodringo-Domingo, 2021; Lie, Rø, & Bang, 2019), and loss (Kjaersdam Telléus, Lauritsen & Rodringo-Domingo, 2021) were also reported in ED patients, even though the findings were mixed. Caslini and colleagues (2016) conducted a systematic review and meta-analysis and revealed that emotional abuse and sexual

abuse were strongly correlated with BN and binge eating disorder (BED). In contrast, physical abuse was linked to any kind of ED. These findings have also been confirmed by subsequent studies (Kimber et al., 2017; Friedman et al., 2023).

Research on psychological trauma has widely emphasized the dose-response effect between adverse childhood experiences and outcomes, recognizing the impact of the cumulative trauma (i.e., exposure to multiple types of adversities) on mental health (Hamby et al., 2021; Hughes et al., 2017). Nonetheless, not all individuals who experienced childhood adversity reported long-term health effects and the need for mental health treatment (Hamby et al., 2021). Recent studies questioned whether the frequency of adverse childhood experiences might truly account for the severity of ED psychopathology, giving more relevance to symptoms of complex posttraumatic stress disorder (CPTSD) (Day et al., 2024) or perception of trauma severity (Trottier & MacDonald, 2017; Lauricella & Jones, 2021). In fact, it has been shown that posttraumatic stress disorder (PTSD) symptoms and CPTSD symptoms have a long-lasting effect on health (Karatzias et al., 2019; McFarlane, 2010). Despite ongoing debate in the literature concerning the optimal indicators of trauma burden on ED psychopathology, several studies reported the cumulative effect of traumatic exposure on ED symptoms (Vidana et al., 2020; Groth et al., 2020; Guillaume et al., 2016), treatment outcomes (Convertino, Morland & Blashill, 2022), and clinical severity in both adult and adolescent populations (Molendijk et al., 2017; Backholm, Isomaa & Birgegard, 2013; Hambleton et al., 2022; Longo et al., 2025).

Furthermore, ED symptoms have been associated with dysfunctional parental bonding, characterized by low care (Grenon et al., 2016), high parental overprotection (Tetley et al., 2014), and attachment insecurity (Tasca, 2019). Factors such as parental mental health, child temperament, social and economic conditions, and competing care demands, may exert influence on the development of secure attachment relationships (Sutton, 2019; Gervai, 2009; Pinquart, 2013). Within the framework of attachment theory (Bowlby, 1969), the quality of early repeated parent–child interactions has a substantial impact on how individuals interact with the world, perceive themselves and others, and regulate emotions

(Tasca & Balfour, 2014), affecting psychosocial development and mental health outcomes (Wolfe & McIsaac, 2011). Therefore, aversive and neglectful repeated parent–child relationships, in which the central attachment figure itself is the source of intense distress, may undermine the perception of the world as a secure place, the possibility of creating trusting relationships with others, and the ability to modulate intense affect, provoking overwhelming emotions that have a traumatic impact on the individual (Lahousen, Unterrainer & Kapfhammer, 2019). Consequently, the presence of multiple traumatic factors, such as childhood abuse and dysfunctional parental bonding, was associated with a greater trauma burden, which had an impact on long-term mental health (Chartier, Walker & Naimark, 2010) as well as ED symptoms (Tasca, 2019; Tasca & Belfour, 2014). As a result, it has been suggested that ED symptoms are a maladaptive mechanism for controlling trauma-related adverse emotions (Hambleton et al., 2022; Mitchell et al., 2021).

Early negative experiences in the context of attachment bonds are often associated with long-lasting changes in emotional and cognitive processing (i.e., expectancies and beliefs about the self, others and the world) (Bär et al., 2023). These early negative events could contribute to developing maladaptive cognitive and emotional patterns known as Early Maladaptive Schemas (EMSs) during childhood or adolescence (Nicol et al., 2020; Costa et al., 2020). EMSs develop as representations of the early child's environment; they influence the elaboration of later experiences and persist throughout life, directing actions and social interactions with other people (Young, Klosko & Weishaar, 2003), as well as shaping personality development (Basso et al., 2019). During adulthood, these schemas can be activated by life events perceived as similar to adverse experiences experienced during childhood, and the activation of these schemas is associated with an increase in emotional arousal (Young, Klosko & Weishaar, 2003). Young (2003) described 18 EMSs grouped into five broad domains (see Table 1) (Young, Klosko & Weishaar, 2003). A number of psychiatric conditions, including eating disorders, obsessive-compulsive disorders, psychosis, anxiety, affective disorders, and posttraumatic stress disorder (PTSD), have been connected to EMSs (Nicol et al., 2020). Patients with a history of trauma

frequently reported EMSs from the domain of disconnection/rejection (Lian, Chooi & Bono, 2023), such as emotional deprivation, social isolation (Pilkington, Bishop & Younan, 2021) mistrust/abuse and defectiveness/shame (Simpson & Smith, 2019). The disconnection/rejection domain also mediates the relationship between childhood trauma and mental disorders such as depression (Rezaei & Ghazanfari, 2016), PTSD (Vasilopoulou et al., 2020) and EDs (Meneguzzo et al., 2021). A systematic review revealed that EMS 'unrelenting standards' were significant across all ED diagnoses, while EMS 'insufficient self-control' was only associated with ED diagnoses characterized by binge eating and purging symptoms (Maher et al., 2022). Moreover, BED severity was linked to emotional deprivation and defectiveness, which are both included in the EMS domain of rejection/disconnection (Aloi et al., 2020). Understanding the mediating role of EMSs in the relationship between childhood trauma and ED psychopathology is critical for identifying further factors that need to be clinically considered and enhancing treatments targeted for ED patients with a history of trauma. Nevertheless, this research field is still in its infancy; in fact, to the best of our knowledge, the mediating role of the 18 specific EMSs has not been extensively investigated (Meneguzzo et al., 2021; Jenkins, Meyer & Blisset, 2013). Moreover, a recent systematic review conducted by Rabito-Alcon and colleagues (2021) highlighted the need to extend knowledge regarding mediators between ED and childhood trauma (Rabito-Alcon, Baile & Vanderlinde, 2021).

Considering that multiple traumatic experiences have shown a cumulative effect on the severity of the clinical presentation (Groth et al., 2020; Messman-Moore & Garrigus, 2007), the objectives of the current study were to (1) compare the Eating Disorder (ED) symptom severity (assessed during the first admission to the Regional Centre for Eating Disorders) and early maladaptive schema (EMS) scores of patients with severe childhood trauma to those with no/mild childhood trauma; (2) investigate the mediating role of EMSs on the relationship between childhood trauma and ED symptom severity. As mentioned above, trauma burden increases when a person experiences multiple traumatic factors; as a consequence, in the present study, severe childhood trauma was defined as having experienced both childhood abuse (i.e., either sexual or physical) and dysfunctional parental

bonding. In contrast, no/mild childhood trauma was defined as having experienced either childhood abuse (i.e., either sexual or physical), dysfunctional parental bonding, or neither. According to the literature (Groth et al., 2020; Pilkington, Bishop & Younan, 2021; Meneguzzo et al., 2021; Brewerton et al., 2020), we hypothesized that severe childhood trauma is linked to more severe ED symptomatology and higher EMS scores. Additionally, we hypothesized that the burden of childhood trauma may indirectly influence the severity of ED symptoms through EMSs, particularly those associated with the disconnection/rejection domain.

Table 1. Description of Early Maladaptive Schemas and Schema Domains

Schema Domain	**Description of the domain**	**Early Maladaptive Schema (EMS)**
Disconnection/Rejection	The belief that one's needs for security, nurturance and empathy will not be satisfied	Abandonment Mistrust/Abuse Emotional Deprivation Defectiveness/Shame Social Isolation
Impaired autonomy/performance	The belief that one's ability to survive and cope autonomously or perform successfully is impaired	Dependence Vulnerability Enmeshment Failure
Impaired limits	Difficulties in controlling impulses, obeying rules, and practicing goal-directed behaviors	Entitlement Insufficient Self-Control
Other-directedness	The needs, desires and responses of other people are overvalued and considered instead of their own needs	Subjugation Self-Sacrifice Approval-Seeking
Overvigilance and inhibition	The spontaneous emotions and drives are repressed and displaced by inflexible internalized norms about performance and conduct	Negativity Emotional Inhibition Unrelenting Standards Punitiveness

3.1.2. Methods of study 1

Study design and participants

The current research is an observational retrospective study. The data were extracted from the Regional Centre for Eating Disorders (ED) registry at the University Hospital of Verona, which has stored sociodemographic and clinical information on all outpatients seeking care since 2014 and was routinely gathered during the first admission to the Regional Centre. Eligibility criteria for the service provision were as follows: patient's age equal or higher than 14 years old; absence of extreme body mass index (BMI) that requires an inpatient's level of care (i.e., BMI < 15.00 kg/m^2); health professionals as referral providers (i.e., pediatricians, general practitioners, mental health professionals, etc.). For the current study, we extracted data on outpatients who were admitted to the Regional Centre between 2014 and 2016 using the following criteria: 1) clinical diagnosis of anorexia nervosa (AN), bulimia nervosa (BN) or other specified feeding or eating disorders (OSFED) according to the DSM-5 criteria [60]; 2) absence of significant psychiatric comorbidity, based on clinical assessment; and 3) completion of self-report questionnaires described in section 'Measures'. The following types of information were also extracted from the registry: sociodemographic data, including sex, age, education level, and marital status, and clinical data, such as height, weight, and body mass index. The study was conducted in compliance with the Declaration of Helsinki and was approved by the local Ethics Committee (CESC Protocol number 48455 of 8 August 2022).

Measures

The *Eating Disorder Inventory* (EDI-3) (Garner, 2004; Giannini et al., 2008) is a standardized questionnaire that evaluates current symptoms and psychological characteristics associated with EDs. It consists of 91 items categorized into three subscales of eating disorder symptoms and nine general psychological subscales, which are relevant but not specific to EDs. The Eating Disorder Risk Composite (EDRC) is obtained by combining the scores from three subscales of ED symptoms (i.e., Drive for Thinness, Bulimia, and Body Dissatisfaction). Regarding psychometric properties, Clausen and colleagues (2011) reported

satisfactory internal consistency of the questionnaire (Cronbach's alpha values ranging from .75 to .92 for ED patients and from .59 to .93 for normal controls). The Cronbach's alpha for the EDRC scale calculated on the study's patients was .82.

The *Young Schema Questionnaire* (YSQ) (Young, 2005; Saggino et al., 2018) is a standardized self-report questionnaire consisting of 232 items. These items are organized into 18 clusters, each representing an early maladaptive schema (EMS). These schemas are further categorized into 5 areas: (1) disconnection/rejection; (2) impaired autonomy/performance; (3) impaired limits; (4) other-directedness; and (5) overvigilance/inhibition (see Table 1). Saggino and colleagues (2018) discovered that the Italian version of the instrument demonstrated strong internal consistency. Specifically, Cronbach's alpha values ranged from .80 to .92 for clinical samples and from .83 to .94 for nonclinical samples. The Cronbach's alpha values for EMS scales calculated on the study's patients ranged from .61 to .84, indicating an acceptable internal reliability (with the exception of 'emotional deprivation' and 'emotional inhibition' EMS scales with a Cronbach's alpha of .58 and .57, respectively, indicating a questionable internal reliability).

The *Childhood Experience of Care and Abuse Questionnaire* (CECA-Q) (Bifulco et al., 2005; Giannone et al., 2011) is a self-administered questionnaire designed to retrospectively assess whether individuals experienced severe adversity during the first 17 years of life. The instrument is composed of two sections. The first section consists of two sets of 16 items that evaluate individuals' perceptions of aversion and neglect from both mothers and fathers. Both dimensions refer to the high-order variable 'lack of care' (Bifulco et al., 2005). A score higher than 25 indicates a severe level of perceived aversion, whereas a score higher than 22 (for the mother) or 24 (for the father) indicates a severe level of perceived neglect (Bifulco et al., 2005). The second part is composed of screening questions pertaining to physical and sexual abuse. The presence of physical and sexual abuse was evaluated with dichotomic responses (yes/no). By combining the results obtained from both sections, the following variables are generated: 1)

abuse: the individual has experienced at least one kind of abuse (i.e., either sexual or physical abuse); 2) problematic parental bonding: the individual has experienced lack of care in terms of neglect or aversion from at least one parent, as indicated by scores higher than the cut-off scores abovementioned. Original validation study showed a Cronbach's alpha of .80 for 'aversion' and .81 for 'neglect' scales (Bifulco et al., 2005). The Italian version of the instrument demonstrated interrater reliability (Cohen's k) ranging from .66 to 1.00 and had high construct validity (Giannone et al., 2011). The Cronbach's alpha values calculated on the study's patients were .49 for the 'aversion' scale (mother), .62 for the 'aversion' scale (father), .51 for the 'neglect' scale (mother) and .76 for the 'neglect' scale (father).

Statistical analysis

Participants were categorized into two groups based on their burden of childhood trauma, according to the CECA-Q criteria outlined by Bifulco and colleagues (2005) (see section 'Measures'): the first group, referred to as 'High Trauma' (HT), comprised outpatients with severe childhood trauma (i.e., both abuse – either sexual or physical abuse - and problematic parental bonding). In contrast, the second group, named 'Low Trauma' (LT), consisted of outpatients with no/mild childhood trauma (i.e., either no abuse - neither sexual nor physical abuse - or no problematic parental bonding, or only one of these factors). To examine differences between the HT and LT groups in terms of sociodemographic and clinical continuous variables, a *t* test was utilized. A χ^2 test was conducted to assess the relationships between categorical variables. A bivariate correlation using Pearson's coefficient was computed to investigate the relationships between continuous variables. The tests were two-tailed, with a significance threshold set at .05. No adjustment for multiple testing was implemented due to the exploratory nature of the study. SPSS 27 was utilized to perform descriptive statistics and statistical tests.

A mediation analysis was conducted using the structural equation modeling procedure with bootstrapping sampling (5,000 replications) in Stata 17. The dependent variable was the EDI-3-EDRC (i.e., the severity of ED symptoms,

measured during the first admission to the Regional Centre for Eating Disorders), the independent variable was childhood trauma experienced before the age of 17, and each of the 18 YSQ EMSs (i.e., long-lasting maladaptive cognitive and emotional patterns that emerge following negative childhood events) was considered a mediator. The threshold for statistical significance in the mediation models was established at .05.

3.1.3. Results of study 1

Forty-two outpatients satisfied the abovementioned criteria (see section 'Study design and participants') for the registry data extraction (of 204 patients who approached the centre between 2014 and 2016, 88 were asked to complete the questionnaires, of which 48% were included in the present analysis), providing data suitable for the present analysis. Within the sample analysed, the percentage of females was 95%. The mean age was 25.0 years (*SD* = 10.1; sample's age ranged from 14 to 54 years old). Fifteen patients had a diagnosis of AN, 10 patients satisfied the criteria for a diagnosis of BN, and 17 patients were diagnosed with OSFED. The mean BMI was 20.05 kg/m^2 (*SD* = 4.18), with a range from 16.00 to 33.00 kg/m^2. Considering the severity of childhood traumatic experiences, 13 individuals (31%) exhibited severe childhood trauma and were classified as part of the HT group, while the remaining 29 participants were classified into the LT group. HT patients were older than LT patients (HT group's mean age = 32.7 (*SD* = 11.4) vs LT group's mean age = 21.5 (*SD* = 7.3)). The HT group had a significantly greater severity of ED symptoms, as shown by the Eating Disorder Risk Composite (EDRC) mean score (p = .017). With respect to YSQ scores, the HT group had a general upwards trend in comparison to the LT group, with scores for emotional deprivation (p = .045), defectiveness (p = .005), failure e (p = .020), vulnerability (p = .049), insufficient self-control (p = .026), and negativity (p = .027) attaining statistical significance. Tables 2 and 3 present sociodemographic and clinical data according to the burden of childhood trauma.

Table 2. Sociodemographic data according to the burden of childhood trauma

Sociodemographic variables	**LT – Low Trauma *N* = 29 (% valid responses[1])**	**HT – High Trauma *N* = 13 (% valid responses[1])**	***p* value**
Gender			
Female	27 (93%)	13 (100%)	.332
Male	2 (6.9%)	0 (0%)	
Age mean (*SD*)	21.5 (7.3)	32.7 (11.4%)	< .001**
Educational level	(1 missing data)		
High	13 (46%)	8 (67%)	.204
Low	15 (54%)	4(33%)	
Marital status			
Single	27 (93%)	9 (69%)	
Married	2 (6.9%)	2 (15%)	.057
Separated	0 (0%)	2 (15%)	

SD = standard deviation; *p* value (significance associated with *t* test); * α≤.05; ** α≤.01

[1]the percentages were calculated based on the number of patients with no missing data.

Table 3. Clinical data according to the burden of childhood trauma

Clinical variables	**LT – Low Trauma *N* = 29**	**HT – High Trauma *N* = 13**	***p* value**
ED diagnosis			
AN	11 (38%)	4 (30.8%)	.868
BN	7 (24.1%)	3 (23.1%)	
OSFED	11 (38%)	6 (46.2%)	
BMI mean (*SD*)	19.31 (3.11)	21.70 (5.73)	.086
YSQ mean (*SD*)			
Emotional deprivation	1.3 (1.8)	3.0 (3.4)	.045*
Abandonment	5.1 (3.8)	7.5 (4.4)	.073
Abuse	3.1 (2.9)	3.8 (3.3)	.535
Social isolation	3.2 (2.7)	4.8 (3.5)	.122
Defectiveness	3.3 (3.9)	7.4 (4.3)	.005**
Failure	2.2 (2.7)	4.5 (3.0)	.020*
Dependence	2.2 (2.9)	4.3 (3.8)	.054
Vulnerability	1.5 (2.3)	3.4 (3.5)	.049*
Enmeshment	1.6 (1.9)	0.8 (1.2)	.157
Subjugation	2.6 (3.4)	3.8 (3.6)	.341
Self-sacrifice	6.2 (5.2)	6.2 (5.6)	.974
Emotional inhibition	2.4 (2.1)	3.4 (2.8)	.256
Unrelenting Standard	4.6 (3.4)	4.1 (2.8)	.680
Entitlement	1.4 (1.9)	2.0 (2.5)	.406
Insufficient Self-control	2.9 (3.1)	5.5 (3.9)	.026*
Approval-seeking	3.6 (4.0)	4.2 (3.4)	.638
Negativity	3.1 (3.2)	5.6 (3.3)	.027*
Punitiveness	3.3 (3.3)	4.9 (3.5)	.160

EDI-3			
EDRC mean score (***SD***)	57.2 (20.2)	73.1 (16.5)	.017*

ED = Eating Disorder; AN = Anorexia Nervosa; BN = Bulimia Nervosa; OSFED = Other Specified Feeding or Eating Disorders; BMI = Body Mass Index; YSQ = Young Schema Questionnaire; EDI-3 = Eating Disorder Inventory-3; EDRC = Eating Disorder Risk Composite; *SD* = Standard Deviation; *p* value (significance associated with *t* test for continuous variable and with χ^2 for categorical variable); * α≤.05; ** α≤.01;

Mediation analyses

Mediation analyses were performed to explore whether EMS played a mediating role in the relationship between childhood trauma and symptoms of ED, as assessed during the first admission to the Regional Centre for Eating Disorders. Figures 1 represents the three mediation models.

A statistically significant relationship was found between severe childhood trauma and ED symptoms, as indicated by the estimated overall effect of severe childhood trauma on ED symptoms in terms of EDRC scores (c = 15.90, p = .007). When considering each EMS as a mediator, only schemas related to defectiveness, failure, and negativity exhibited a significant effect. Since there was no significant relationship between age and the following variables: EDRC score (r = .22, p = .165), defectiveness (r = .01, p = .979), failure (r = .04, p = .809), or negativity (r = -.02, p = .891), no adjustment for age was made. Severe childhood trauma had a significant positive effect on defectiveness (i.e., raised levels of scores) (a = 4.04, 95% CI: [1.32, 6.75], p = .004). Additionally, defectiveness had a significant positive effect on symptoms of eating disorders (b = 1.49, 95% CI: [0.28, 2.70], p = .016). After adjusting for defectiveness, the direct effect of severe childhood trauma on symptoms of eating disorders was lower but not statistically significant compared to the overall effect (c^1 = 9.88; 95% CI: [-2.09, 21.86], p = .106) (see Figure 1a). Severe childhood trauma had a significant indirect effect on eating disorder symptoms through defectiveness, with a coefficient of 6.02 (95% CI: [-0.17, 12.21], p = .057). The defectiveness accounted for 38% of the total effect.

The positive effect of severe childhood trauma on failure had a coefficient of 2.25 (95% CI: [0.40, 4.11], p = .017), whereas the coefficient for the positive effect of

failure on symptoms related to eating disorders was 2.59 (95% CI: [0.86, 4.33], p = .003). After adjusting for failure, the direct effect of severe childhood trauma on ED symptoms decreased, but the difference was not statistically significant (c^1 = 10.05; 95% CI: [-1.98, 22.09], p = .101) (see Figure 1b). The indirect effect of severe childhood trauma on ED symptoms through failure was 5.85 (95% CI: [-0.02, 11.72], p = .051), and the percentage of the total effect mediated by failure was 37%. The coefficient for the positive effect of severe childhood trauma on negativity was 2.48 (95% CI: [0.36, 4.60], p = .022), while that for the positive effect of negativity on symptoms of eating disorders was 1.83 (95% CI: [0.33, 3.32], p = .017). Severe childhood trauma had a direct effect on symptoms of EDs, even after adjusting for negativity. The estimated coefficient for this direct effect was 11.38 (95% CI: [-0.13, 22.89], p = .053) (see Figure 1c). Additionally, an indirect effect of severe childhood trauma on eating disorder symptoms was found through negativity. The estimated coefficient for this indirect effect was 4.52 (95% CI: [-1.05, 10.10], p = .112). The percentage of the total effect that was mediated by negativity was 28%. The results of the mediation analyses for all 18 EMSs are shown in Table 1.A (see Appendix).

Figure 1. Representation of the three mediation models

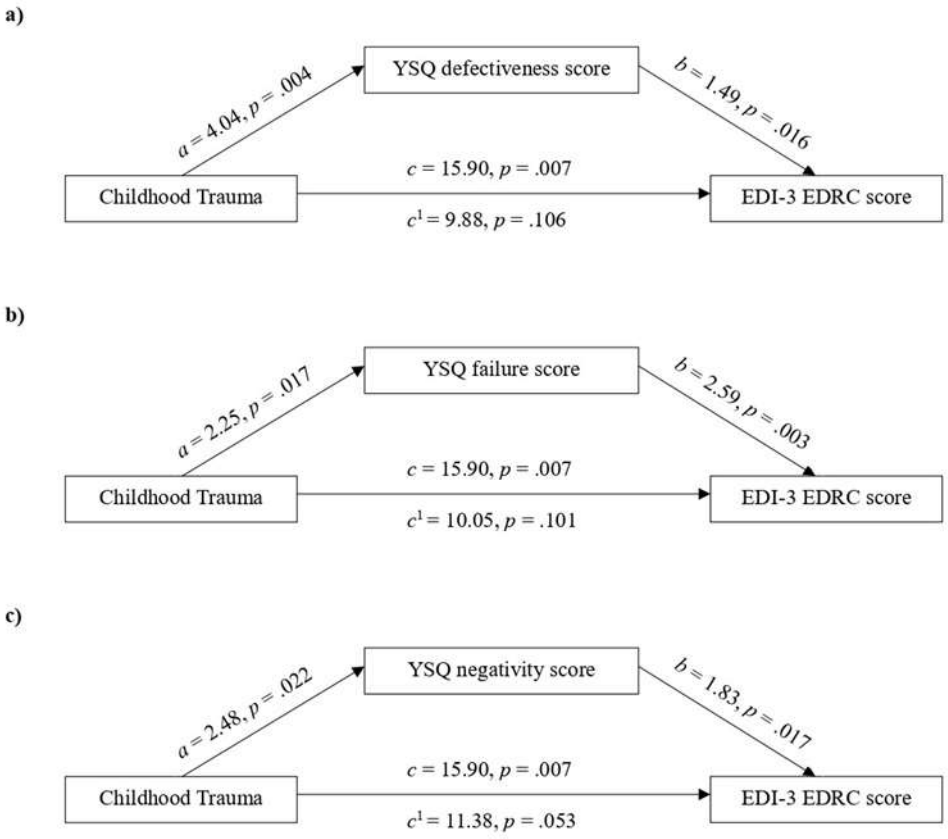

Fig. 1. Childhood Trauma measured as a categorical variable (High Trauma vs Low Trauma) = independent variable; EDI-3 EDRC score = dependent variable; YSQ defectiveness score, YSQ failure score, and YSQ negativity score = mediators; YSQ = Young Schema Questionnaire; EDI-3 = Eating Disorder Inventory-3; EDRC = Eating Disorder Risk Composite; *a* = coefficient relating the independent variable to the mediator; *b* = coefficient relating the mediator to the dependent variable adjusted for the independent variable; *c* = coefficient relating the independent variable to the dependent variable; c^1 = coefficient relating the independent variable to the dependent variable adjusted for the mediator.

Mediation analysis with multiple mediators

The inclusion of defectiveness, failure, and negativity as multiple mediators resulted in a decrease in the direct positive effect of severe childhood trauma on symptoms of eating disorders. However, this decrease was not statistically

significant (c^1 = 8.64; 95% CI: [-3.83, 21.11], p = .174). Through all three mediators, the indirect positive impact of severe childhood trauma on ED symptoms was 7.26 (95% CI: [-0.47, 14.06], p = .036); through defectiveness, failure, and negativity, it was 1.94, 4.23, and 1.07, respectively.

Overall, 46% of the effect was mediated by all three mediators combined. When examining each mediator individually, the percentages of the overall effect that was mediated by defectiveness, failure, and negativity were 12%, 27%, and 7%, respectively. Figure 2 graphically represents a mediation model with multiple mediators, as shown below (Fig. 2).

Figure 2. Graphic representation of mediation analysis with defectiveness, failure and negativity as multiple mediators

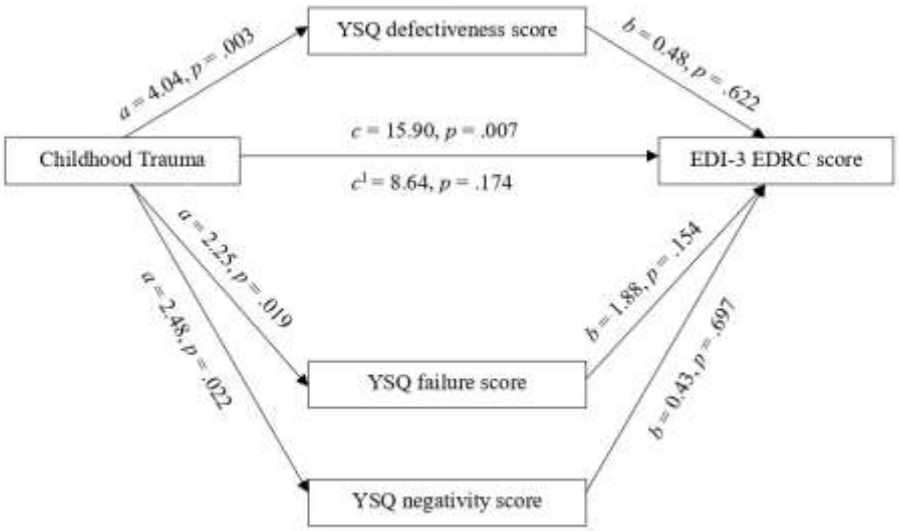

Fig. 2. Childhood Trauma measured as a categorical variable (High Trauma vs Low Trauma) = independent variable; EDI-3 EDRC score = dependent variable; YSQ defectiveness score, YSQ failure score, YSQ negativity score = mediators; YSQ = Young Schema Questionnaire; EDI-3 = Eating Disorder Inventory-3; EDRC = Eating Disorder Risk Composite; a = coefficient relating the independent variable to the mediator; b= coefficient relating the mediator to the dependent variable adjusted for the independent variable; c = coefficient relating the independent variable to the dependent variable; c^1 = coefficient relating the independent variable to the dependent variable adjusted for the three mediators combined.

3.1.4. Discussion of study 1

The main objective of the present work was to investigate the mediating role of EMSs in the association between childhood trauma and ED symptom severity. Literature has widely highlighted that EDs are influenced by a complex interaction between psychosocial and biological factors, within a trauma history may play its part (Frank, 2016). Moreover, EMSs have been shown to play a mediating role in the association between psychopathology and trauma history (Rezaei & Ghazanfari, 2016; Vasilopoulou et al., 2020). These results in the field of ED are still preliminary. The current research partially corroborated the findings of Meneguzzo and colleagues (2021), who discovered a mediating effect of the disconnection/rejection domain. Our findings showed that the degree of defectiveness (i.e., belief about oneself as defective and unlovable), failure (i.e., belief about oneself as incapable of achieving goals), and negativity (i.e., negative beliefs about life, minimizing positive aspects) mediated the relationship between childhood trauma and the severity of ED symptoms.

Furthermore, our results showed that patients with severe childhood trauma were older and reported greater severity of ED symptoms during the first admission to the Regional Centre, compared to patients with no/mild childhood trauma. This finding is in line with previous literature, which has already highlighted a positive association between a more severe clinical presentation of ED psychopathology and a history of multiple traumatic experiences (Groth et al., 2020; Messman-Moore & Garrigus, 2007). According to several authors (Hambleton et al., 2022; Mitchell et al., 2021), in traumatized individuals, ED symptoms are considered a maladaptive coping mechanism for managing PTSD symptoms. Therefore, patients who experienced childhood abuse against the backdrop of dysfunctional parental bonding may be more engaged in ED behaviors such as dietary restriction, binge eating, and purging to manage adverse emotions and intrusive memories related to trauma. This could explain the greater severity of ED symptoms in these patients.

Additionally, compared to ED patients with no/mild childhood trauma, ED patients with severe childhood trauma generally exhibited significantly greater

EMS scores for emotional deprivation, defectiveness, failure, vulnerability, insufficient self-control, and negativity. According to Young's (2003) definition of EMSs—persistent cognitive and emotional patterns derived from early adverse life experiences—these findings supported the link between EMSs and trauma history (Bär et al., 2023; Young, Klosko & Weishaar, 2003). Emotional deprivation and defectiveness refer to the domain of disconnection/rejection, whereas vulnerability and failure refer to the domain of impaired autonomy/performance. These two domains were found to be prevalent in our data, which is consistent with the findings of a recent systematic review conducted by Lian and colleagues (2023). Insufficient self-control and negativity refer to the domains of impaired limits (i.e., difficulty in controlling impulses, engaging in goal-directed behaviour, and following rules) and overvigilance/inhibition (i.e., tendency to suppress feelings, impulses, and choices), respectively.

Although these two EMSs have been reported less frequently in trauma patients, our data suggest that they are associated with severe childhood trauma. This link may be explained by the fact that the whole study sample was characterized by an ED diagnosis. In fact, a range of personality profiles, such as the overcontrolled/inhibited and the undercontrolled/dysregulated subtypes, have been observed in the ED field (Turner et al., 2014). Both undercontrolled/dysregulated and overcontrolled/inhibited personality subtypes were associated with emotion regulation problems, as shown by Donnellan & Robins (2010). We hypothesized that severe childhood trauma could maximize engagement in these dysfunctional personality patterns in ED patients. Particularly, the undercontrolled/dysregulated subtype is characterized by impulsivity, high sensitivity to rewards, and low effortful control and it has been more associated with BN and binge-eating symptoms. On the other hand, individuals with an overcontrolled/inhibited subtype, are characterized by high sensitivity to punishment, emotional vulnerability, rigidity, and inhibition of feelings (Turner et al., 2014; Donnellan & Robins, 2010; Isaksson et al., 2021) and they were more likely to exhibit restricting symptoms, such as restrictive AN and atypical AN (Isaksson et al., 2021).

EMSs develop when core emotional needs are not met during infancy; thus, from the attachment perspective (Bowlby, 1969), experiencing early relationships with caregivers characterized by a lack of responsiveness, insensibility, and insecurity impacts the way people face and regulate emotions (Tasca & Balfour, 2014). Therefore, it has been shown that greater difficulties in emotion regulation were generally associated with all EMS domains, even though the magnitude of the correlations was greater for EMS 'disconnection/rejection', 'impaired autonomy', and 'overvigilance/inhibition' domains, and, specifically, for EMS 'defectiveness/shame' and 'negativity' (Pilkington et al., 2024).

According to Pugh (2015), EMSs may influence several aspects of ED pathology, including risk behaviors, comorbidities, emotion dysregulation, and the severity of the ED. Furthermore, prior research has shown that ED behaviors, such as purging, dietary restriction, and overexercise, play a role in the avoidance of negative emotions linked to schema activation (Pugh, 2015; Brown et al., 2016). Within this framework, severe childhood trauma fosters the development of dysfunctional cognitive and emotional patterns - Early Maladaptive Schemas - that lead individuals to perceive life as negative and themselves as unlovable, defective, and failed. As a consequence, a greater severity of ED symptoms, which is indicative of greater cognitive and behavioural engagement in restrictive and/or binge-eating patterns, may represent a more dysfunctional attempt to avoid unpleasant emotions associated with this schema activation.

Research on EDs has highlighted that ED individuals often experience stigmatization (Foran, O'Donnell & Muldoon, 2020). ED-related stigma is associated with feelings of shame, fear of criticism, and social isolation (Puhl & Suh, 2015). The difficulty in processing these negative emotions could trigger and reinforce the EMSs, particularly those of 'disconnection/rejection', 'impaired limits', and 'impaired autonomy' domains (Faustino & Vasco, 2020), suggesting a potential bidirectional relationship between EMSs and ED behaviors. Furthermore, past studies have shown that highly traumatized individuals were likely to exhibit self-stigma and lack of trust in healthcare systems, which may make it harder to seek treatment early (Spikol et al., 2024; Smith, Workneh & Yaya, 2020). Similarly, greater negative self-images and cognitive beliefs about

themselves as undeserving of care have been shown to represent a barrier to treatment seeking and utilization (Liu, Hay & Conti, 2022). As a result, we speculate that the higher age of patients with severe trauma - characterized by a greater representation of self as unlovable, defective, and incapable of achieving goals (i.e., greater EMSs 'defectiveness' and 'failure') – may be due to the lack of early access to healthcare services. Given the cross-sectional design of the study, we also hypothesized that severe ED pathology itself could contribute to the belief of being incapable of achieving goals (i.e., EMS 'failure'). This is in line with the cognitive-interpersonal model showing how severe and enduring ED disease may impact the view of the self (Treasure et al., 2020).

Our findings strengthened the need for ED psychotherapy treatments to focus on the EMSs, which are the primary target of Schema Therapy, an integrative therapy that combines traditional cognitive-behavioral techniques with elements from psychodynamic, gestalt, constructivism, and attachment models (Pugh, 2015). Despite its infancy, research on the application of Schema Therapy to EDs has shown promising results, including a reduction in ED symptoms and general psychopathology (Joshua et al., 2023). Schema therapy has been used both alone (Ansari et al., 2020; Rasouli et al., 2020; Simpson et al., 2010) and in conjunction with cognitive-behavioral therapy, particularly when traditional cognitive-behavioral techniques appear to have limited response (Pugh, 2015; Simpson & Slowey, 2011; Simpson, 2012). Pugh (2015) emphasized that traditional cognitive-behavioral treatment can be re-applied later, once obstacles are overcome with schema therapy procedures (Pugh, 2015). Overall, it has been shown that Schema Therapy may be a valuable alternative for patients with high comorbidity and complexity and those who are unresponsive to first-line treatments (e.g., cognitive-behavioral therapy) (Pugh, 2015; Simpson & Smith, 2019; Mares et al., 2024).

A strength of this study concerns the systematic collection of data regarding all outpatients who were admitted to the Regional Centre for Eating Disorders. Moreover, internationally well-validated tools were used to assess clinical variables (i.e., ED symptomatology, trauma history, and EMSs).

Nevertheless, the current study also has several limitations. First, the sample size was small, and the percentage of ED patients included in the study was low compared to the number of ED patients who approached the Regional Centre for Eating Disorders. This is particularly evident in the High Trauma group. This reduced the representativeness of the study sample; thus, our findings should be interpreted with caution. These aspects allow only an explorative approach to the data analysis, and it was not possible to conduct subgroup analyses. Moreover, no information about trauma in adulthood was collected; thus, it was not possible to account for these events. We exclusively collected data about childhood sexual and physical abuse without considering other types of childhood trauma exposure mentioned in the ED literature. Further studies should use measures that examine a broader range of childhood trauma (e.g., ACEs questionnaire). Moreover, we only considered the 'lack of care' dimension for evaluating parental bonding without including other related aspects such as overcontrol. Further studies should use tools that allow a more comprehensive assessment of parental bonding. Since the severity of trauma is subjective, another limitation of the study is the lack of evaluation of the perceived impact of trauma exposure, trauma-related symptoms, and other trauma-related factors (i.e., duration, the relationship with the abuser, and the individual meaning of the traumatic event), which could be a key aspect to explore in subsequent trauma research, given the different subjective reactions of individuals to trauma history. Moreover, the study did not include a healthy control group or another comparison clinical group since data were collected in a clinical centre specialized for ED treatment.

Further studies should compare ED patients with healthy controls or other clinical samples, given that it could be relevant for better understanding the role of trauma in the expression of psychopathology. The unavailability of clinical data such as AN subtype, previous treatment experiences, other psychiatric symptoms, and ED duration did not allow to investigate the role of clinical history on the trauma – ED symptoms severity relationship and the potential role of confounding factors (i.e., depressive symptoms) in explaining results; thus, future research should consider these variables.

In addition, due to the small sample size, we did not investigate whether the kind of ED diagnosis influences the relationship between childhood trauma burden and ED symptoms. This should be a future research direction, because exploring whether ED diagnosis acts as an effect modifier is critical for understanding whether the relationship between childhood trauma burden and ED symptoms may be different according to ED diagnosis. Finally, all the data were collected through self-reported instruments, which may have introduced recall and social desirability bias. Hence, prospective longitudinal studies and multimethod assessments could be considered for further research in the field of ED and trauma.

3.1.5. Conclusion of study 1

The current study explores a relatively new field of research and provides preliminary evidence for the potential relevance of EMSs in the relationship between trauma history and ED psychopathology. Furthermore, the association between childhood trauma and ED severity reinforces the need to evaluate the trauma burden in ED patients and treat the trauma component. As a result, some authors have already begun to assess add-on trauma-focused therapy, such as eye movement desensitization and reprocessing (EMDR), to evidence-based treatments for ED (e.g., cognitive–behavioral therapy) (Rossi et al., 2024; Ergüney-Okumuş, 2021; Yaşar et al., 2019).

In addition, our findings emphasize the importance of taking EMSs into account when treating ED patients who have a history of childhood trauma. EMSs represent a transdiagnostic concept that is relevant for the comprehension of dysfunctional and pervasive changes in cognitive and emotional processing that sustain the symptoms of mental disorders. To modify and reduce these EMSs, schema therapy was introduced. It has been shown that schema therapy is an effective treatment for conditions other than personality disorders (Bär et al., 2023). Therefore, few recent studies have applied schema therapy for the treatment of ED symptomatology, and promising results have been reported (Pugh et al., 2015; Joshua et al., 2023; McIntosh et al., 2016).

Further research on the application of schema therapy in the ED field is needed to better understand the role of EMSs in ED pathology and to improve the treatment response in ED patients who do not receive any advantage from first-line treatments. Future longitudinal studies with larger sample sizes will be necessary to confirm these data.

3.2. STUDY 2: The Role of Appearance-related Comments and Interoceptive Deficits in Eating Disorders: An Exploratory Study in a 1-year Cohort of Outpatients (Fasolato, Bonetto et al. (2025), *Journal of Eating Disorders*)

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The role of appearance-related comments and interoceptive deficits in eating disorders: an exploratory study in a 1-year cohort of outpatients

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Abstract

Background Eating Disorders (EDs) are often marked by an altered body experience, stemming from a lack of integration between the first-person's (i.e., egocentric view) body representation—based also on internal bodily sensations (i.e., interoceptive signals)—and the third-person's (i.e., allocentric view) body representation, which may be influenced by the recall of comments from others on one's own appearance. This study examined the prevalence of retrospectively self-reported eating-, appearance-, and person-related comments among ED outpatients, and investigated whether the self-reported onset of appearance-related comments, interoceptive deficits (i.e., difficulty in perceiving internal bodily states), and interpersonal sensitivity were associated with the ED severity. It also explored the psychopathological profile of patients characterized by the co-occurrence of self-reported appearance-related comments received prior to the ED onset and clinical interoceptive deficits.

Methods Data were extracted from the Regional Centre for Eating Disorders registry at the University Hospital of Verona, including self-reported measures of ED and general psychopathology, as well as sociodemographic and clinical information. Descriptive and inferential analyses were performed.

Results A total of 89 ED outpatients satisfied the criteria for registry data extraction. Eating- and appearance-related comments were retrospectively reported by 94.4% of outpatients, whereas 57.1% of them retrospectively reported negative person-related comments. The severity of ED psychopathology was significantly associated with the self-reported onset of appearance-related comments prior to the ED onset and a clinical level of interoceptive deficit.

Conclusions Outpatients who experienced both these factors showed a more severe clinical presentation, particularly in terms of global psychopathology and restrictive symptoms, regardless of any ED diagnosis. The results showed the frequent occurrence of retrospectively self-reported eating- and appearance-related comments, even

3.2.1. Introduction of study 2

Eating disorders (EDs) are severe and costly mental disorders that affect physical health, social functioning, and quality of life (Attia & Walsh, 2025). According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR) (American Psychiatric Association, 2022), the primary characteristic of eating disorders is the disruption in eating or eating-related behaviors (Attia & Walsh, 2025). Additionally, a number of studies have also highlighted that patients with anorexia nervosa (AN) (classified into restricting AN (AN-R) subtype or binge-purging AN (AN-BP) subtype), bulimia nervosa (BN), binge eating disorder (BED), and certain patients with otherwise specified feeding or eating disorders (OSFED) also exhibit body image disturbance (American Psychiatric Association, 2022; Todisco, 2018; Lewer et al., 2017), which can take many different forms, including body dissatisfaction, weight and shape concerns, body-related checking, avoidant behaviors (e.g., to avoid looking at one's own body in the mirror or wearing clothes that cover the body) and impaired body size estimation (Lewer et al., 2017).

From a neuroscientific perspective, the way individuals experience their own body comes from combining information from senses (e.g., sight, hearing, touch, and internal bodily sensations) and from different perspectives. The first-person point of view (also named 'the egocentric view') refers to how individuals perceive their own body from the inside. The third-person point of view (also named 'the allocentric view') reflects how the body is represented from the outside, as if seen from an external observer's viewpoint (Brizzi et al., 2023).

According to research on spatial cognition, the short-term, first-person body perception - which mainly relies on internal bodily sensations known as interoceptive signals (i.e., hunger, heartbeat, pain, etc.) - can integrate with and update the third-person body representation (Candia-Rivera et al., 2024; Serino et al., 2015; Byrne, Becker & Burgess, 2007).

However, in EDs this process seems to be impaired (Serino et al., 2015; Riva, 2012), suggesting deficits in integrating body-related information from different sensory modalities and perspectives (Brizzi et al., 2023; Riva & Dakanalis, 2018). These deficits have been differentiated into two components. The first is the

disruption in linking internal bodily signals with pleasant/aversive consequences, which also affects the abilities to recognize and regulate internal emotional states. The second component is a lock to a negative third-person representation of the body, which cannot be further updated by first-person sensory body inputs, even after pronounced weight changes (see Allocentric Lock Theory) (Riva, 2012; Riva & Gaudio, 2018). In this context, ED symptoms represent a dysfunctional strategy to cope with the persistent negative memories patients have of their body (Riva, Gaudio & Dakanalis, 2015).

More broadly, EDs involve a more profound disruption of the embodiment - the way in which individuals experience their own body – that leads individuals to represent the body as an object from an observer's point of view (Burychka, Miragall & Baños, 2021; Cascino et al., 2019; Riva, 2014). From a socio-cultural theoretical framework, this third-person body representation has been called self-objectification (Fredrickson & Roberts, 1997). This process is often associated with the recollection of experiences of being objectified by family members or strangers, given that receiving any form of comment about appearance acts as an interpersonal feedback reminder that the body is looked at and visually judged by others (Slater & Tiggermann, 2015; Calogero, Herbozo & Thompson, 2009). Likewise, Riva and colleagues (2015) (Riva, Gaudio & Dakanalis, 2015), drawing from spatial memory research, suggested that individuals may internalize an objectified representation of their own body when they adopt a third-person perspective. This occurs when they remember emotionally arousing situations of physical appearance-based judgment, which involve a shift in attention from being situation-focused to self-focused.

Research found that higher levels of self-objectification were associated with lower interoceptive abilities (Du et al., 2023; Tiggermann & Williams, 2012; Peat & Muehlenkamp, 2011; Ainley & Tsakiris, 2013), which, in turn, have been frequently reported across all EDs (Jenkison, Taylor & Laws, 2018). However, authors have not always agreed about the temporal relationship between interoceptive abilities and self-objectification (Fredrickson & Roberts, 1997; Ainley & Tsakiris, 2013; Van de Veer, van Herpen & van Trijp, 2015; Felig et al., 2022). Some studies on non-clinical samples highlighted the mediatory role of

poor interoception in the relationship between self-objectification and eating problems, suggesting that interoceptive deficits may contribute to how self-objectification influences ED symptoms. However, these studies are cross-sectional, and thus temporal sequence cannot be established (Peat & Muehlenkamp, 2011; Myers & Crowther, 2008).

The exposure to weight and appearance-related comments (Wansink, Latimer & Pope, 2017; Menzel et al., 2010) has also been shown to be associated with eating problems (Varnagirytė & Perminas, 2021; Dahill et al., 2021). Gagné and colleagues (2023) found that nearly half of the adolescents' sample was exposed to negative weight-related comments from at least one person, and comments from friends were the most linked to appearance dissatisfaction and sensitivity to negative evaluation by others. In addition, Dahill and colleagues (2021) found that these comments have often been provided by parents. Poor social functioning, negative self-evaluation, high appearance sensitivity, and anxiety seemed to act as mediators in the relationship between parental appearance-related teasing and disordered eating, suggesting that parental words may affect the offspring's self-schema and, consequently, behaviors and coping mechanisms (Dahill et al., 2021).

On the contrary, studies regarding clinical samples have shown mixed results. Some case-control studies have found that self-reported comments made by family members or other people regarding eating, weight, and shape were a common specific retrospective correlate of AN and BN (Gonçalves et al., 2016; Wade, Gillespie & Martin, 2007; Pike et al., 2008; Machado et al., 2014). However, other studies have found no difference with health controls or identified these comments as risk factors for general psychopathology (Gonçalves et al., 2016; Grogan et al., 2020). Overall, the appearance and weight-related teasing seemed to be a contributing factor for the development of eating problems, rather than a cause, consistent with the equifinality principle of psychopathology (Dahill et al., 2021).

Overall, numerous studies have investigated body experience either through experimental paradigms (e.g., laboratory-based tasks), from a socio-cultural perspective, or by focusing on body image-related constructs in non-clinical and

clinical populations. However, to our knowledge, no study has examined, in a clinical population of ED individuals, the role of the co-occurring presence of the following factors: (1) the retrospective recall of past experiences of being judged based on physical appearance (Riva, Gaudio & Dakanalis, 2015; Calogero, Herbozo & Thompson, 2009) and (2) the difficulty in perceiving internal bodily states (i.e., interoceptive deficits) (Candia-Rivera et al., 2024; Serino et al., 2015; Riva, 2012). Moreover, interpersonal sensitivity has been identified as a factor associated with increased vulnerability to external feedback and poorer mental health outcomes (Topalalioğlu, 2025; Hidese et al., 2022; Atlas, 2004). Thus, it may represent an additional relevant variable to consider when examining the relationship between the abovementioned factors and the ED psychopathology. From these premises, the current study aimed:

1) to examine, in a 1-year cohort of ED outpatients, the frequency of retrospectively self-reported comments regarding eating habits, appearance, and one's own person (i.e., comments regarding self-worth, abilities, or performance) received by other people, also stratifying by ED diagnosis and the self-reported onset of such comments in relation to the ED onset (i.e., whether they started before or after the ED onset);
2) to investigate whether and how the severity of ED psychopathology was associated with a) the retrospectively self-reported onset of appearance-related comments in relation to the ED onset (i.e., prior or subsequent to the ED onset), b) the degree of interoceptive deficit (i.e., clinical vs. non-clinical level), and c) the interpersonal sensitivity. In detail, we hypothesized that a history of self-reported appearance-related comments prior to the ED onset, a clinically significant interoceptive deficit, and higher interpersonal sensitivity would be associated with increased severity of ED psychopathology;
3) to explore whether specific psychopathological features characterized ED patients presenting both a clinically significant interoceptive deficit and retrospectively self-reported appearance-related comments received prior to ED onset, in comparison to those presenting only one of these factors or neither of them. Consistent with previous findings based on Allocentric

Lock Theory (Riva, 2012), which posits that ED symptoms may serve as a way to handle negative memories of one's objectified body (i.e., allocentric view), we hypothesized that the co-occurring presence of a clinical interoceptive deficit and appearance-related comments retrospectively recalled as being received prior to ED onset was associated with higher levels of emotion dysregulation and greater severity of ED symptoms.

3.2.2. Methods of study 2

Research design and participants

The current research is an observational cross-sectional study. The study also includes the retrospective report of comments relating to eating, appearance, and one's own person as recalled by the patients. The data were extracted from the Regional Centre for Eating Disorders registry at the University Hospital of Verona, which stores clinical and sociodemographic information of ED outpatients collected during the initial psycho-diagnostic assessment. For the current study, the data were extracted according to the following criteria: (1) first outpatient visit between 1 January and 31 December 2024; and (2) clinical diagnosis of anorexia nervosa (AN), bulimia nervosa (BN), binge eating disorder (BED), or otherwise specified feeding or eating disorder (OSFED). Furthermore, the following sociodemographic and clinical information was extracted from the registry: sex, age, weight, height, body mass index, and age of ED onset. The eating-, appearance-, and person-related comments were retrospectively reported by the patient through the completion of an ad hoc schedule (see 'Measures' section). The study was conducted in compliance with the Declaration of Helsinki and was approved by the local Ethics Committee (CESC Protocol number 48455 of 8 August 2022).

Measures

The *Words Count Questionnaire* (WCQ) is an ad hoc schedule designed to retrospectively investigate whether the patient reports having received any lifetime comment regarding 1) eating habits (what/how much/how the patient

eats), 2) appearance (weight/body shape/physical aspect), and 3) person itself (personal values/skills/performance). The schedule is filled out by the patient, and it collects information through questions regarding the type of person who made the comments, the patient's age at the time of the first comment, the length of time, and some words the patient can still recall. Additionally, using a five-point Likert scale (1-5), the schedule examined the degree to which each type of comment was distressing at the time and now (See Appendix for details about the WCQ questions).

The *Eating Disorder Inventory-3* (EDI-3) (Garner, 2004; Giannini et al., 2008) is a standardized questionnaire that evaluates ED symptoms and common psychological features associated with EDs. It is composed of 91 items categorized into three subscales related to ED symptoms (i.e., Drive for Thinness, Bulimia, and Body Dissatisfaction) and nine psychological subscales (i.e., Low Self-esteem, Personal Alienation, Interpersonal Insecurity, Interpersonal Alienation, Interoceptive Deficits, Emotional Dysregulation, Perfectionism, Asceticism, and Maturity Fears). The Eating Disorder Risk Composite (EDRC) is obtained by summing the scores of three subscales related to ED symptoms. According to the instrument, EDI-3 scores higher than the 70^{th} percentile are considered in the range of clinical interest. Therefore, in this study we considered the cut-off of the 70^{th} percentile for the 'interoceptive deficits' subscale: a score higher than 70^{th} indicates clinically relevant interoceptive deficits. The instrument showed a satisfactory internal consistency (Cronbach's alpha values from 0.75 to 0.92 for ED patients and from 0.59 to 0.93 for nonclinical samples) (Clausen et al., 2011). In the current study sample, internal consistency based on Cronbach's Alpha values ranged from 0.67 (Perfectionism) to 0.91 (Drive for Thinness). Notably, the Cronbach's Alpha for the EDRC scale was 0.91 (see Table 2.A in Appendix for details).

The *Eating Disorder Examination* (EDE 17.0) (Cooper, Cooper & Fairburn, 1989; Calugi et al., 2017) is a semi-structured interview considered the 'gold-standard' measure for ED psychopathology (Guest, 2000). It assesses the range and severity of ED behaviours in the last 28 days, and it is composed of 28 items rated on a seven-point, forced-choice rating scale (0-6). The instrument comprises four

subscales: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern. A total score is calculated as the mean of all subscales' scores, in which higher scores indicate higher severity or frequency of ED features. Regarding psychometric properties, Calugi and colleagues (2017) reported satisfactory internal reliability (Cronbach's alpha values ranged from 0.65 to 0.84), high inter-rater reliability (Spearman rho ranging from 0.93 to 0.99) and good criterion validity of the instrument. In the current study sample, internal consistency (Cronbach's Alpha) ranged from 0.66 (Weight Concern) to 0.79 (Shape Concern). The Cronbach's Alpha for the total scale was 0.87 (see Table 2.A in Appendix for details).

The *Revised version of Symptom Checklist-90* (SCL-90-R) (Derogatis, 1994; Prunas et al., 2012) is a standardized self-report questionnaire composed of 90 items rated on a five-point Likert scale. It assesses clinical symptoms in the last seven days, grouped in the following subscales: Somatization, Obsessive–Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism. A Global Severity Index (GSI) was calculated as the mean of all item scores, and it is considered an index of global psychopathology. Prunas and colleagues (2012) found good internal consistency of the Italian version (Cronbach's alpha values ranging from 0.70 to 0.96). Cronbach's Alpha in the current sample ranged from 0.67 (Paranoid Ideation) to 0.87 (Depression). The Cronbach's Alpha for the Global Severity Index (GSI) was 0.96 (see Table 2.A in Appendix for details).

Statistical Analysis

Continuous variables were described by mean, standard deviation (SD), median, and range. Categorical variables were given by frequency distribution. A Chi-square test was performed to evaluate the relationship between the occurrence of self-reported eating/appearance/person-related comments and the type of ED diagnosis. A Chi-square test was also performed to explore the association between the type of ED diagnosis and the self-reported onset of comments in relation to the ED onset. Based on the comparison between the age at the time of the ED onset and the patient's reported age at the time of the first comment

received, the comment was categorised by the researcher as 'prior to the ED onset' or 'subsequent to the ED onset'. The content of the retrospectively self-reported appearance-related comments (i.e., collected through the following WCQ item: *'What specific words do you remember from those comments?'*) was categorised by a researcher into one of the following predefined categories: 'overweight-related comments' and 'underweight-related comments'. With regard to the eating-related comments, the researcher also examined whether the words remembered by the patient contained references concerning the physical appearance/body shape/weight. Moreover, the patients were categorized in two groups based on the co-occurring presence of a clinical interoceptive deficit (i.e., an 'interoceptive deficit' EDI-3 scale score higher than the 70th percentile) and retrospectively self-reported appearance-related comments received prior to the ED onset. The first group, named 'High impaired Body Experience' (HiBE), included patients with *both* 1) a clinical interoceptive deficit and 2) retrospectively self-reported appearance-related comments received by others prior to the ED onset. The second group, named 'Low impaired Body Experience' (LiBE), included patients with who had only one of these factors (i.e., a clinical interoceptive deficit *or* retrospectively self-reported appearance-related comments received prior to the ED onset), or *neither* of them. A Chi-square test was performed to assess the association between the group and the self-reported onset of eating and person-related comments. The Shapiro-Wilk test was performed to assess the normality of the distributions. T-test and Mann-Whitney test, for normal and non-normal score distributions, were applied, where appropriate, in order to investigate the differences between 'HiBE' and 'LiBE' groups in continuous variables regarding age, clinical characteristics, comment-related features, general psychopathology, and ED psychopathology. Given the exploratory nature of this observational study based on data extracted from a clinical registry, no adjustment for multiple testing and no a priori power calculation were performed. The sample size was determined by the number of cases in the registry that met the predefined inclusion criteria (see section 'Research Design and Participants'). Accordingly, the final sample includes all eligible cases identified within a one-year time frame. A linear regression analysis

was performed in order to examine the association between the severity of ED psychopathology and clinical variables (i.e., the degree of interoceptive deficit, the self-reported onset of appearance-related comments in relation to the ED onset, and interpersonal sensitivity) that were selected on the basis of the previous clinical and neuroscientific studies relating to the disturbance of body experience in EDs (Serino et al., 2015; Riva & Gaudio, 2018; Atlas, 2004). We included in the model the EDE total score (i.e., the severity of ED psychopathology in the last 28 days) as the dependent variable, interoceptive deficits categorized according to their clinical relevance (i.e., the EDI-3 'interoceptive deficit' subscale score higher vs. lower or equal to the 70th percentile), the self-reported onset of appearance-related comments (before vs. after the ED onset), and the interpersonal sensitivity score measured by the SCL-90-R as the independent variables. The interaction effect between the degree of interoceptive deficit and the self-reported onset of appearance-related comments was examined. The levels of reference were the self-reported onset of appearance-related comments subsequent to the ED onset and EDI-3 interoceptive deficit score lower than or equal to the 70th percentile.

All tests were bilateral at $p<0.05$. Statistical analyses were performed by using Jamovi 2.3 (2022).

3.2.3. Results of study 2

The enrolled sample was composed of 89 ED outpatients, of whom 93.3% were females. The mean age was 27.9 (SD=14.0; range=13-66), and the mean Body Mass Index (BMI) was 24.1 kg/m² (SD=9.1; range=13.0-56.9 kg/m²). The diagnoses were distributed as follows: 25.8% (N=23) AN (of which 87% (N=20) had the AN-R subtype and 13.0% (N=3) had the AN-BP subtype), 14.6% (N=13) BN, 40.4% (N=36) OSFED, and 19.1% (N=17) BED. The mean age of ED onset was 17.4 years (SD=6.15; median=16; range=8-40). Sixty-seven (75.3%) outpatients showed a score higher than the 70th percentile in the EDI-3 subscale 'Interoceptive Deficit.'

Eating-, appearance-, person-related comments

A total of 94.4% (N = 84) of outpatients retrospectively reported having received at least one lifetime comment about their eating habits. Among these, 27.4% of the words recalled by patients were categorized as referring to their physical appearance/body shape/weight (e.g., *'You eat too much, so you get fat'*). The same percentage of patients (94.4%, N = 84) also retrospectively reported having received at least one comment about their appearance. Among them, 73.8% retrospectively recalled words that were categorized as 'overweight-related comments' (e.g., *'You are chubby'*), while 22.6% retrospectively recalled words that were categorized as 'underweight-related comments' (e.g., *'I can see your bones'*). Additionally, 57.1% (N = 48) of outpatients retrospectively reported having received at least one negative person-related comment over their lifetime (see Table 1 for further details). Among those who reported having received eating-related comments, 25.0% (N = 21) were diagnosed with AN, 15.5% (N = 13) with BN, 40.5% (N = 34) with OSFED, and 19.0% (N = 16) with BED, with no significant group differences ($\chi^2(3) = 1.19$, $p = .756$). The same distribution was found among those who reported having received appearance-related comments ($\chi^2(3) = 1.19$, $p = .756$). In the subgroup who reported having received negative person-related comments, 22.9% (N = 11) were diagnosed with AN, 10.4% (N = 5) with BN, 37.5% (N = 18) with OSFED, and 29.2% (N = 14) with BED. Group differences did not reach statistical significance ($\chi^2(3) = 6.13$, $p = .105$). When exploring the association between ED diagnosis and the self-reported onset of the first comment (i.e., occurred before or after the ED onset), a statistically significant association emerged only for eating-related comments ($\chi^2(3) = 8.25$, $p = .041$). No significant differences were found for appearance-related ($\chi^2(3) = 5.54$, $p = .136$) or negative person-related comments ($\chi^2(3) = 5.91$, $p = .116$) (see Table 2). A qualitative description of the main words retrospectively recalled by the patients for each type of comment was provided in Table 3.

Table 1. Description of the characteristics related to each type of comment (n=89)

	Eating-related comments (what, how, how much)[1]		**Appearance-related comments (weight or body shape)[1]**		**Negative person-related comments (skills, performance or personal values)[1]**	
	N (missing data)	%	*N* (missing data)	%	*N* (missing data)	%
Patient's age at the time of the first comment[1]						
	13.5 (9.0)	-	13.9 (8.6)	-	13.6 (10.1)	-
Mean (SD)	11.5		12.0		12.0	
Median	4-60		4-60		4-57	
Range						
By intimate people (parents, siblings, partner)[1]	71	81.6	45	51.7	30	61.2
By relatives[1]	32	36.8	28	32.2	10	20.4
By friends[1]	38	43.7	37	42.5	9	18.4
By acquaintances[1]	18	20.7	42	48.3	17	34.7
By strangers[1]	3	3.4	9	10.3	1	2.0
By teachers[1]	3	3.4	12	13.8	7	14.3
By health professionals[1]	3	3.4	6	6.9	1	2.0
Extremely distressing in that moment[2]	35 (1)	42.2	46 (1)	55.4	36	75.0
Extremely distressing now[2]	29 (1)	34.9	33 (2)	36.6	24	50.0

[1]all data were retrospectively self-reported by patients using Word Count Questionnaire (WCQ); [2]frequency of patients who indicated a score of '5' in the 5-point Likert scale of WCQ; SD = Standard Deviation

Table 2. Frequency distribution of self-reported onset of comments prior to or after the ED onset according to the ED diagnosis (n=89)

	Eating-related comments (what, how, how much)			**Appearance-related comments (weight or body shape)**			**Negative person-related comments (skills, performance, or personal values)**		
	Missing data	Prior to the ED onset % (*N*)	After the ED onset % (*N*)	Missing data	Prior to the ED onset % (*N*)	After the ED onset % (*N*)	Missing data	Prior to the ED onset % (*N*)	After the ED onset % (*N*)
AN	5	72.2 (13)	27.8 (5)	2	66.7 (14)	33.3 (7)	12	100.0 (11)	-
BN	-	53.8 (7)	46.2 (6)	-	61.5 (8)	38.5 (5)	9	100.0 (4)	-
OSFED	3	90.0 (30)	9.1 (3)	2	88.2 (30)	11.8 (4)	18	88.9 (16)	11.1 (2)
BED	1	81.3 (13)	18.8 (3)	1	68.8 (11)	31.3 (5)	4	69.2 (9)	30.8 (4)

Note: missing data were due to the absence of patient's reporting of the age at the time of the first comment; ED Eating Disorder; AN = Anorexia Nervosa; BN = Bulimia Nervosa; OSFED = Otherwise Specified Feeding and Eating Disorder; BED = Binge Eating Disorder

Table 3. Description of the main words retrospectively recalled by patients

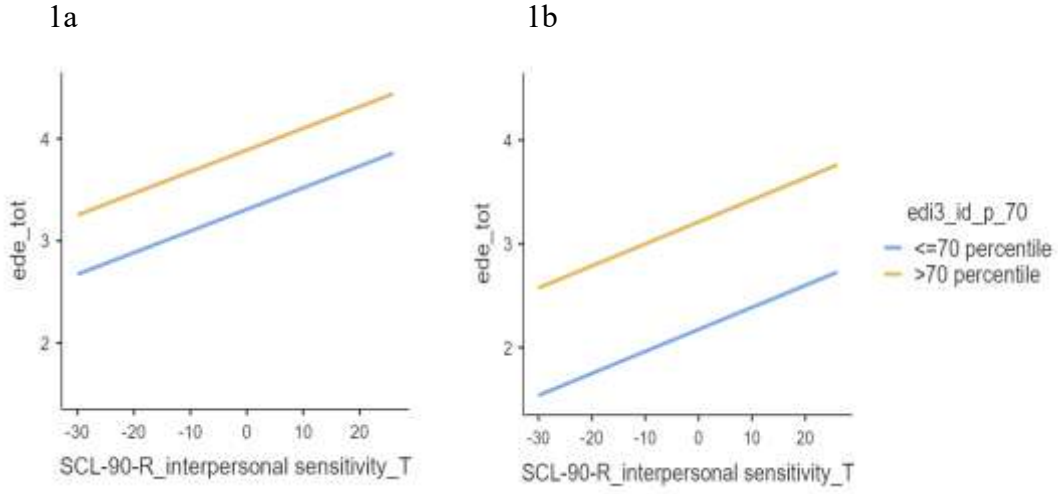
Eating-related comments		**Appearance-related comments**		**Negative person-related comments**
with references concerning the physical appearance/body shape/weight	**without references concerning the physical appearance/body shape/weight**	**categorised as 'overweight-related comments'**	**categorised as 'underweight-related comments'**	
'it's no use complaining that you don't lose weight if you eat so much' 'you ate too much, you're getting fat' 'it's an obese person's meal' 'lucky you, you eat so much and you're so thin' 'but where do you put all that stuff? Don't you think you're exaggerating? If you go on like this, you'll burst, don't complain if you get fat. 'eat less, fat girl' 'she's thin, but if you saw everything, she eats you would be scared' 'stop, regulate yourself, just don't eat, just get big'	'how do you eat everything', 'you can't control your diet' 'you eat badly' 'eat too little' 'eat unregulated and unbalanced' 'eat too many sweets' 'eat too few vegetables, proteins and carbohydrates' 'you should eat more carbohydrates' 'how can you still be hungry?' 'stop eating that you feel guilty'	'I don't like you because you are fat' 'what tummy rolls you have' 'you are bloated' 'do you really weigh that much?' 'lose weight and you will be more beautiful' 'see the shoulders? Too big for a girl' 'when your thighs no longer touch, you will be perfect' 'you are too heavy' 'you don't look good in that dress, it's all stretched out' 'you have to change size'	'you look like a skeleton' 'are you anorexic?' 'put on a few extra kilos' 'look really worn out' 'eat more because you are too skinny' 'how thin you are, you'll disappear in a while' 'you have legs like two breadsticks' 'you can see your spine' 'you look great with those kilos off' 'you're skin and bones' 'you can see your ribs'	'you are a bad mother' 'you don't get anything done, you are a kept woman' 'crazy' 'incapable' 'failed' 'you're a failure, I don't trust you, you're distressing' 'whether you're there or not is the same, you're not capable of doing anything'

Linear regression analysis

A linear regression analysis was performed to investigate the association between the severity of ED psychopathology and the following variables: degree of interoceptive deficit, self-reported onset of appearance-related comments in relation to the ED onset, and interpersonal sensitivity. The model included the

severity of ED psychopathology in terms of EDE total score as the dependent variable, the degree of interoceptive deficit (i.e., EDI-3 'interoceptive deficit' subscale score higher vs. lower or equal to the 70th percentile), the self-reported onset of appearance-related comments (i.e., before or after the ED onset), and the interpersonal sensitivity score measured by SCL-90-R as the independent variables. The model was statistically significant (F(3, 79) = 6.29, p= .001), with an adjusted R^2=0.203. In detail, an increased severity of ED psychopathology was significantly associated with the self-reported onset of appearance-related comments prior to the ED (β=0.724; SE= 0.320; p=0.006) and a clinical level of interoceptive deficit (β=0.646; SE= 0.337; p=0.019). The association with the interpersonal sensitivity score was close to statistical significance (β=0.209; SE = 0.011; p=0.050). No interaction effect between the degree of interoceptive deficit and the self-reported onset of appearance-related comments emerged (β=0.363; SE= 0.644; p=0.482) (see figures 1a and 1b).

Figure 1. Graphic representation of the linear regression model



1a. Self-reported onset of the appearance-related comments prior to the ED onset; **1b.** Self-reported onset of the appearance-related comments subsequent to the ED onset. EDE total score = continuous dependent variable; degree of interoceptive deficit (EDI-3 'interoceptive deficit' subscale score higher vs. lower or equal to 70th percentile = categorical independent variable; Self-reported onset of appearance-related comments (before vs. after the ED onset) = categorical independent variable; Interpersonal sensitivity score = continuous independent variable; id= interoceptive deficit; ED = Eating Disorder; SCL-90-R= Revised version of Symptom Checklist-90; EDE = Eating Disorder Examination; EDI-3= Eating Disorder Inventory-3; p = percentile; T = t score

The co-occurrence of retrospectively self-reported appearance-related comments prior to the ED onset and interoceptive deficit

The co-occurrent presence of a clinical interoceptive deficit (i.e., an EDI-3 'interoceptive deficit' score higher than the 70th percentile) and retrospectively self-reported appearance-related comments before the ED onset characterized 51.6% (N=46) of the sample. These outpatients were included in the 'High impaired Body Experience' (HiBE) group. The remaining outpatients were included in the 'Low impaired Body Experience' (LiBE) group. 'HiBE' group included 89.1% (N=41) females, whereas the 'LiBE' group encompassed 97.7% (N=42) females ($X^2(1)=2.58$, p =.108). No statistically significant differences emerged between groups regarding ED diagnoses ($X^2(3)=3.78$, p =.286). The 'HiBE' group included 17.4% (N=8) of AN, 17.4% (N=8) of BN, 19.6% (N=9) of BED, and 45.6% (N=21) of OSFED. The 'LiBE' group included 34.9% (N=15) of AN, 11.6% (N=5) of BN, 18.6% (N=8) of BED, and 34.9% (N=15) of OSFED. 89.1% of the 'HiBE' group, compared to 51.2% of the 'LiBE' group, reported having received the first eating-related comment prior to the ED onset ($X^2(1)=12.2$, $p < .001$), whereas 52.2% of the 'HiBE' group, compared to 37.2% of the 'LiBE' group, reported having received the first negative person-related comment prior to ED onset ($X^2(1)=0.215$, p =.643). 82.6% of the 'HiBE' group, compared to 55.8% of the 'LiBE' group, recalled words that were categorized as 'overweight-related comments' ($X^2(1)=4.41$, p = .036), whereas 8.7% of the 'HiBE' group, compared to 34.9% of the 'LiBE' group, recalled words that were categorized as 'underweight-related comments' ($X^2(1)$ =11.6, $p < .001$). Statistically significant differences between the 'HiBE' group and the 'LiBE' group in EDI-3, EDE, and SCL-90-R subscales' scores were reported in Table 4.

Table 4. Comparison between 'HiBE' (High impaired Body Experience) and 'LiBE' (Low impaired Body Experience) groups in characteristics, EDI-3 percentile scores, EDE scores, and SCL-90-R t scores (n=89)

		HiBE GROUP (*N*=46) *M (SD)*	**LiBE GROUP (*N*=43) *M (SD)***	**Statistics**	***p*-value**
	Age	27.0 (12.8)	28.8 (15.4)	U=975	*.908*
	BMI	25.0 (9.13)	23.2 (9.01)	U=808	*.137*
	Age of ED onset	17.3 (4.98)	17.6 (7.25)	U=879	*.365*
	Patient's age at the time of the first eating-related comment[1]	11.4 (5.64)	14.5 (9.07)	U=582	**.028**
	Patient's age at the time of the first person-related comment[1]	12.4 (6.26)	13.4 (11.1)	U=237	.990
EDI-3	Drive for Thinness	82.8 (15.6)	70.7 (26.2)	*U* = 5.325	**.021**
	Bulimia	75.4 (25.7)	68.7 (31.6)	*U* = .731	.392
	Body Dissatisfaction	80.0 (19.3)	69.1 (25.4)	*U* = 5.430	**.020**
	Eating Disorder Risk Composite (EDRC)	85.2 (12.1)	75.1 (23.6)	*U* = 3.284	.070
	Low Self-Esteem	79.8 (18.9)	72.4 (25.7)	*U* = 1.635	.201
	Personal Alienation	79.9 (22.0)	75.6 (23.2)	*U* = 3.001	.083
	Interpersonal Insecurity	77.7 (21.3)	64.5 (32.4)	*U* = 2.572	.109
	Interpersonal Alienation	71.0 (26.1)	64.5 (27.6)	*U* = 1.866	.172
	Emotion Dysregulation	76.4 (20.5)	57.2 (25.0)	*U* = 14.696	**<.001**
	Perfectionism	67.3(24.9)	61.2 (28.1)	*U* = 1.093	.296
	Asceticism	83.8 (15.6)	64.4 (26.7)	*U* = 14.545	**<.001**
	Maturity Fears	64.4 (28.5)	62.3 (28.1)	*U* = 0.239	.625
EDE	Dietary Restraint	3.48 (1.70)	2.45 (1.71)	*U* = 9.715	**.002**
	Eating Concern	3.37 (1.48)	2.80 (1.63)	*F* (1) = 2.926	.091
	Weight Concern	4.13 (1.35)	3.25 (1.65)	*U* = 6.182	**.013**
	Shape Concerns	4.62 (1.08)	3.98 (1.44)	*U* = 3.808	.051
	Total	3.95 (1.03)	3.11 (1.31)	*F* (1) = 11.586	**<.001**

SCL-90-R	Somatization	63.5 (13.1)	58.4 (12.1)	F (1) = 3.668	.059
	Obsessive-Compulsive	68.1 (10.9)	61.4 (11.2)	F (1) = 8.173	**.005**
	Interpersonal Sensitivity	68.5 (11.0)	63.1 (12.7)	F (1) = 4.639	**.034**
	Depression	70.8 (13.9)	66.7 (11.6)	F (1) = 2.299	.133
	Anxiety	68.9 (13.8)	59.3 (11.8)	U = 10.245	**.001**
	Hostility	59.3 (12.7)	52.4 (9.4)	U = 7.455	**.012**
	Phobic Anxiety	72.1 (18.3)	58.4 (15.9)	U = 14.385	**<.001**
	Paranoid Ideation	61.3 (9.4)	55.4 (11.1)	F (1) = 7.337	**.008**
	Psychoticism	72.0 (13.2)	62.2 (13.0)	U = 12.619	**<.001**
	Global Severity Index	70.5 (15.1)	63.6 (10.7)	U = 11.527	**<.001**

HiBE= High impaired Body Experience; LiBE = Low impaired Body Experience; EDI-3 = Eating Disorder Inventory-3; EDE= Eating Disorder Examination; SCL-90-R= Revised version of Symptom Checklist-90; ED = Eating Disorder; *M* = Mean; *SD* = Standard Deviation; *p*-values < .05 are bold; [1]data were retrospectively self-reported by patients using Word Count Questionnaire (WCQ); Note: HiBE group included patients who exhibited *both* a clinical interoceptive deficit and self-reported appearance-related comments prior to the ED onset. LiBE group included patients who had only one of these factors (i.e., a clinical interoceptive deficit *or* appearance-related comments prior to the ED onset), or *neither* of them.

3.2.4. Discussion of study 2

The findings highlighted that both self-reported onset of appearance-related comments prior to the ED onset and the clinical interoceptive deficit were positively associated with an increased severity of ED psychopathology. Additionally, being more sensitive to interpersonal cues appears to further contribute to the severity of ED symptoms. The interplay between interpersonal sensitivity and the predominance of first person's perspective vs. third-person's perspective in relation to one's own body may represent an interesting research area that warrants further investigation.

Taken together, the study showed an additive effect, rather than an interaction effect, among the abovementioned variables, consistent with the cumulative effect of risk factors in the prediction of mental outcomes (Appleyard et al., 2005). This

is consistent with the previous neuroscientific and clinical studies which highlighted that both the interoceptive deficit - difficulty to perceiving internal bodily states - and the adoption of a third-person/objectified perspective on one's own body, often shaped by recalling past social experiences of being judged based on appearance (Calogero, Herbozo & Thompson, 2009), may contribute to a more profound impairment in body experience, thereby leading to greater engagement in ED symptoms (Riva, Gaudio & Dakanalis, 2015; Burychka, Miragall & Baños, 2021).

Regardless of the ED diagnosis, almost the whole sample retrospectively reported having received at least one comment regarding appearance and eating habits, consistent with previous studies (Gonçalves et al., 2016;Wade, Gillespie & Martin, 2007; Pike et al., 2008). While most patients with AN, OSFED, and BED reported having received their first eating-related comment before the onset of ED, in the case of BN, the self-reported onset of such comments occurred with a similar frequency both before and after the onset of the disorder. Nevertheless, this finding should be interpreted with caution due to the small sample size. Future studies with larger samples are needed to confirm this result.

According to patients' retrospective reports, eating-related comments were more frequently received from intimate people such as parents, partners, and siblings, with whom it is more frequent to share daily meals. On the other hand, appearance-related comments, as retrospectively reported by patients, have been received more from both intimate people and acquaintances, as such comments are primarily based on observable physical features, irrespective of the depth of the interpersonal relationship.

Additionally, ED patients who retrospectively reported having received appearance-based comments prior to the ED onset and who also had a clinical interoceptive deficit exhibited higher scores in specific facets of body image disturbance, such as the affective component (i.e., body dissatisfaction), as well as more general indicators of body image disturbance, such as weight concerns (Prnjak et al., 2021). Overall, regardless of any specific categorical ED diagnosis, this subgroup of patients exhibited a more severe clinical profile in terms of general and ED psychopathology, particularly about behavioural/cognitive

restrictive symptomatology, as reported by the patients themselves and as evaluated by clinicians.

Furthermore, they also exhibited more severe emotion dysregulation and higher levels of asceticism (i.e., the tendency to deny physical pleasures) compared to those who reported neither a clinical interoceptive deficit nor self-reported appearance-related comments prior to the ED onset, or only one of these factors. These findings suggest that a more profound body image disturbance and a more severe clinical profile may characterize ED patients who experienced the co-occurrence of difficulties in perceiving internal bodily signals and the recall of third-person perspective feedback regarding their own physical appearance prior to the ED onset. In addition, these patients retrospectively recalled more frequent words regarding 'being overweight' and less frequent words regarding 'being underweight'. This result aligns with previous findings suggesting an association between fat talk and greater body image disturbance (Mills & Fuller-Tyszkiewicz, 2017). Nevertheless, as this study relies on patients' retrospective recall of such lifetime comments rather than on objective documentation, it is possible that patients may have also received other types of comments that were not reported. The comments that were recalled are likely those perceived as most impactful or memorable.

The mean age at which patients in this subgroup retrospectively reported having received their first eating-related comment was younger compared to those who reported neither a clinical interoceptive deficit nor self-reported appearance-related comments prior to the ED onset, or only one of these factors. According to Dawes and colleagues (2025), the influence of such comments on this group may be particularly detrimental, as younger individuals appear to be more vulnerable to the harmful effects of teasing. This heightened vulnerability could be related to their still-developing cognitive, social, and emotional skills, which may limit their ability to interpret non-literal comments. The higher severity of restrictive symptomatology, along with a greater difficulty in regulating emotions in this subgroup, may suggest that these patients use eating control as a dysfunctional way to handle negative contents of the allocentric/objectified body memories (Riva, Gaudio & Dakanalis, 2015). This is consistent with previous studies, which

propose that dietary restriction might serve as an emotion regulator, potentially helping to lessen unpleasant emotional internal states such as fear, anxiety, and shame (Brockmeyer et al., 2012; Haynos & Fruzzetti, 2011).

As far as we are aware, no previous study has investigated, in a clinical population, the association between the ED severity and the co-occurrence of these key factors related to the individual's bodily experience: difficulties in perceiving internal bodily states (i.e., interoceptive deficits) and the recall of past body-objectifying experiences, such as being judged based on appearance. By employing the Allocentric Lock Theory as a theoretical framework, this exploratory study represents a preliminary attempt to address this gap and to offer a more ecologically and clinically relevant understanding of how the co-occurrence of these factors contributes to the ED psychopathology.

One of the main strengths of the study was the use of standardized and well-validated instruments for the assessment of psychopathology. Additionally, the different types of comments retrospectively reported by patients were explored in detail using a specifically developed ad hoc schedule. Data were also systematically collected from a one-year cohort of outpatients attending the Regional Centre for Eating Disorders due to a first outpatient visit. Nevertheless, the present study also presents some limitations. Firstly, due to the small sample size, the findings cannot be readily generalized. Future studies should aim to include larger samples to enable more detailed analyses and improve the external validity of the findings. Moreover, no p-value adjustment for multiple testing and a priori power analysis were conducted, due to the exploratory approach of the study. Hence, the results should be interpreted with caution and confirmed in future. The study did not include either a healthy control group or a clinical comparison group. This was primarily due to the fact that data were collected in a specialized clinical center focused exclusively on the treatment of EDs. Including both non-clinical samples and patients with other psychiatric conditions in future studies would enable a more comprehensive understanding of the specific and potentially transdiagnostic role of body-related experiences in the expression of psychopathology. The use of self-reported instruments and the retrospective report of eating, person, and appearance-related comments - collected using an ad hoc

schedule, a non-standardized and non-empirically validated measure – constitute another weakness of the study. The comments were solely reported by the patients themselves, which may have introduced recall bias as well as social desirability bias. Nevertheless, what we are primarily interested in is the fact that patients recall these comments. The act of recalling these judgmental experiences related to body image may contribute an objectified self-representation (Calogero, Herbozo & Thompson, 2009). Moreover, the present study did not directly measure self-objectification, and the interoceptive deficit has just been measured by using a self-report instrument, without including other behavioural measures of interoceptive perception (i.e., heartbeat perception task). Future studies should adopt a prospective longitudinal design, and use multi-informant and multi-method approaches, such as clinician-rated instruments and ecological momentary assessment (EMA), as well as behavioural tasks.

3.2.5. Conclusion of study 2

The present study, based on clinical empirical data, showed that ED patients frequently reported, retrospectively, having received eating and appearance-related comments from their social context, even before the ED onset. Moreover, the findings highlighted that interoceptive deficits and retrospectively self-reported past experiences of being judged by others based on physical appearance may contribute to the severity of ED psychopathology. The co-occurrence of these factors was associated with a worsening of the global clinical picture. These findings seem to align with existing neuroscientific frameworks, such as the Allocentric Lock Theory, which suggests that EDs may arise from a disturbance in how the body is experienced and remembered.

According to this theory, ED patients may experience a disconnection from their egocentric, first-person bodily experience and remain locked into a negative, allocentric (observer's view) body representation, which may also be shaped by recalling past experiences of being judged by others.

These results highlight the importance of incorporating the assessment of both these bottom-up and top-down factors into the psychodiagnostics and therapeutic processes in ED treatment. One promising intervention is Virtual Reality (VR)-

based therapy (Ferrer-Garcia, Gutiérrez-Maldonado & Riva, 2013), which can induce changes in body representation through multisensory tactile-visual conflicts (e.g., the Full Body Illusion) (Salomon et al., 2016) and the manipulation of spatial egocentric/allocentric reference frames (see the Body Swap Illusion) (Petkova & Ehrsson, 2008). This technology creates an artificial egocentric embodiment of a virtual body and generate prediction errors between the expected body image and actual sensory input (Di Natale et al., 2024), thereby facilitating the updating of distorted mental body representations (Ferrer-Garcia, Gutiérrez-Maldonado & Riva, 2013) and reducing body size distortion (Brizzi & Riva, 2024).

Furthermore, the integration of somatic modification techniques within VR, as proposed by the Regenerative Virtual Medicine approach (Malighetti et al., 2022), may be potential for targeting both the bottom-up and top-down processes of body experience. Nevertheless, additional research is necessary to explore the clinical effectiveness of these interventions in the field of EDs.

3.3. STUDY 3: Identifying Affective Patterns in Patients with Eating Disorders: A Latent Profile Analysis (*Under Review*)

3.3.1. Introduction of study 3

Eating Disorders (EDs) are severe mental disorders characterized by disturbance in eating behaviors, medical complications, and low quality of life, with a lifetime prevalence from 2% to 5% (Attia & Walsh, 2025). The Diagnostic and Statistical Manual of Mental Disorders, fifth edition, Text Revision (DSM-5-TR; APA, 2022) categorizes EDs into the following diagnostic groups: Anorexia Nervosa (AN), classified into two subtypes: restricting AN (AN-R) and binge-purging AN (AN-BP), Bulimia Nervosa (BN), Binge Eating Disorder (BED), Other Specified Feeding or Eating Disorders (OSFED) (e.g., atypical Anorexia Nervosa), and Unspecified Feeding or Eating Disorders (UFED). Nevertheless, high rates of psychiatric comorbidity and diagnostic crossover can affect the course of illness and the treatment responses (Levinson et al., 2022). As a result, new transdiagnostic dimensional approaches to EDs have been emerging (Livney et al., 2025; Forbush et al., 2018), aiming to overcome the limitations of categorical diagnostic systems in mental health (Eaton et al., 2023).

One of the transdiagnostic hallmarks is the presence of poor emotional skills, including difficulties in identifying, describing, and regulating one's own emotions (Nowakowski et al., 2013; Monell et al., 2018; Brockmeyer et al., 2014; Henderson et al., 2019). These difficulties are considered a key maintenance factor in ED psychopathology (Trompeter et al., 2021; Treasure & Schmidt, 2013) and have also been associated with greater clinical severity (Wolz et al., 2015; Lavender et al., 2015).

Recent meta-analytic research has shown that maladaptive emotion regulation strategies (e.g., rumination, emotion avoidance, and suppression) were broadly associated with all EDs at both the symptom and the diagnostic levels (Trompeter et al., 2021; Prefit et al., 2019; Leppanen et al., 2022; Puttevils et al., 2021). Moreover, some authors suggest that engagement in ED behaviors such as dietary restriction, vomiting, or binge-eating episodes may serve as dysfunctional ways for regulating intolerable negative emotions (Trompeter et al., 2021; Lavender et al., 2015).

Nevertheless, the importance of considering ED subtypes in emotion regulation research has also been highlighted (Danner et al., 2014; Brockmeyer et al., 2014). Isaksson and colleagues (2021) identified distinct emotion control styles across ED diagnoses, distinguishing between an undercontrolled/dysregulated profile - characterized by high impulsivity and emotional expression - predominantly associated with BN and binge-eating symptoms, and an overcontrolled/inhibited profile - marked by high inhibitory control and low levels of impulsivity and emotional expression - more commonly associated with AN and atypical AN.

Within the Affective Neuroscience framework, emotions and emotion regulation processes are at the basis of personality development, as well as mental health issues (Panksepp, 1998). Drawing on neurobiological and evolutionary findings, Panksepp and colleagues (2006) identified primary emotional systems that represent the evolutionarily oldest part of the human personality. These basic emotional systems, also defined as emotional endophenotypes (Panksepp, 2006), are shaped by neurobiological mechanisms as well as environmental stressors, and their imbalance may also contribute to the onset of mental disorders (Brienza et al., 2023; Panksepp, 2006). In a bottom-up manner, these systems - shared with other mammalian species - drive specific patterns of behavior and emotional responses (Montag et al., 2017); hence, they are also referred to as emotional/motivational systems (Montag et al., 2021).

These responses are further shaped by experience-dependent learning (secondary processes) and higher-order cognitive functions (tertiary processes), which exert top-down regulatory influences on the emotional expression (Panksepp, 2011).

The primary emotional systems identified by Panksepp and colleagues (2006) are the following (capitalization is used as in the original article): 1) CARE – promotes nurturance behavior and sensitivity to newborn babies and puppies, facilitating attachment bonding; 2) SADNESS – organizes the alarm behaviors of the attachment system, such as separation distress calls (i.e., crying), and mediates feelings of aloneness and panic, activating ancestral pain codes; 3) PLAY – mediates the urge to play, in particular rough-and-tumble play, which enables individuals to explore social possibilities and rules; 4) FEAR – promotes, in response to unconditional danger stimuli, defensive responses such as freezing

and flight behaviors, as well as feelings of anxiety. Other conditional cues can activate this system by conditioning it, leading to fear and inhibitory/avoidant actions; 5) RAGE – is aroused by frustration or attack signals. It promotes defensive responses such as fight behaviors, as well as feelings of anger; 6) SEEKING – is activated by all environmental changes and it mediates appetitive desires and euphoric reward anticipation, promoting exploratory behavior and motivation to get resources from the environment (Panksepp, 2006; 2012). CARE, PLAY, and SEEKING represent positive primary emotional systems that mediate approaching tendencies, whereas SADNESS, FEAR, and RAGE represent negative primary emotional systems that promote distancing behaviors (i.e., defending or moving away) (Giacolini et al., 2024; Montag et al., 2021).

To explore these primary emotional systems in humans, the self-report questionnaire *Affective Neuroscience Personality Scales* (ANPS) was developed (Davis et al., 2003). However, because completing a self-report questionnaire inherently involves cognitive processes, findings from the ANPS should be considered as thought-mediated approximations of primary emotional systems (Davis & Panksepp, 2011).

A theoretical connection between Panksepp's Affective Neuroscience framework and EDs was previously proposed by Treasure (2012); however, to date, we are not aware of any studies that have examined primary emotional systems using the ANPS in clinical populations of ED patients. Only Roithmeier and colleagues (2024) have analyzed the relationship between primary emotional systems and eating symptoms in a non-clinical sample, finding that overall eating symptomatology was negatively associated with positive emotional systems and positively associated with negative emotional systems.

To fill this gap, the present study aimed to identify distinct empirically derived profiles of primary emotional systems within a clinical group of ED patients according to a person-centered approach, which accounts for the heterogeneity of the sample and enables the investigation of the balance between positive and negative primary emotional systems within subgroups (Orri et al., 2017).

Second, the present study explored differences between these profiles in terms of socio-demographic variables (i.e., age, sex, and employment status), clinical

variables (i.e., ED diagnosis, Body Mass Index (BMI), illness duration, psychiatric comorbidity, and trauma burden), and psychopathological variables, including ED severity and depressive/anxious symptoms, as depression and anxiety disorders are the most prevalent psychiatric comorbidities in the ED population (Attia & Walsh, 2025).

Finally, the association between profile membership and the abovementioned clinical and psychopathological variables was examined. Despite the exploratory nature of the study, we hypothesized - based on previous literature (Isaksson et al., 2021) - the presence of one profile characterized by heightened activation of negative primary emotional systems and a second profile marked by a general deactivation of all primary emotional systems. Furthermore, we expected that the latter profile would be more associated with restrictive-based ED diagnoses, such as AN and atypical AN.

3.3.2. Methods of study 3

Study design and participants

The current research is an observational cross-sectional study. The data were extracted from the Regional Centre for Eating Disorders (ED) registry at the University Hospital of Verona, covering the period from 1st January 2023 to 30th June 2025. The registry contains sociodemographic and clinical information routinely collected during the first psychodiagnostic assessment of outpatients seeking care at the Centre. For the purpose of this study, the data extraction satisfied the following criteria: 1) clinical diagnosis of AN, atypical AN, BN, or BED according to the DSM-5-TR; 2) completion of the Affective Neuroscience Personality Scales (ANPS 2.4) (see section 'Measures'). In addition, the following types of information were also extracted from the registry: sociodemographic data (i.e., sex, age, and employment status), clinical data (i.e., body mass index, psychiatric comorbidity, and illness duration), *Eating Disorder Examination* (EDE), *Revised version of Symptom CheckList-90* (SCL-90-R), *Life Stressor Checklist- Revised, The Impact of Event Scale -Revised* (IES-R) scores. The study was conducted in compliance with the Declaration of Helsinki and was approved by the local Ethics Committee (CESC Protocol number 48455, 8th August 2022).

Measures

The *Affective Neuroscience Personality Scales* (ANPS 2.4) (Davis et al., 2003; Giacolini et al., 2017) is a self-reported questionnaire designed to assess six primary emotional systems identified by Panksepp and colleagues (2006). The instrument consists of 112 items, rated on a 4-point Likert scale ranging from 0 (totally disagree) to 3 (totally agree). Among these, 16 items are fillers, while the remaining items are organized into six subscales (i.e., Seeking, Care, Play, Fear, Sadness, and Anger), each corresponding to one of the primary emotional systems. This instrument is increasingly employed in psychiatric research (Brienza et al., 2023; Montag et al., 2021), and the items have been formulated to capture individual emotional experiences and behaviors as directly as possible (e.g., '*I sometimes cannot stop worrying about my problems'*) rather than cognitive judgments (Davis et al., 2003). The internal reliability of the ANPS subscales ranges from 0.65 to 0.86 in the original validation (Davis et al., 2003), whereas the Italian validation demonstrated that internal consistency ranges from 0.71 to 0.78 in the clinical samples (Giacolini et al., 2017).

The *Eating Disorder Examination* (EDE 17.0) (Cooper et al., 1987; Calugi et al., 2015) is a semi-structured clinical interview designed to assess the range and the severity of ED behaviors in the past 28 days. The instrument comprises 28 items rated on a seven-point rating scale from 0 (never) to 6 (every day). These items are grouped into four subscales: Dietary Restraint, Eating Concern, Weight Concern, and Shape Concern. A total score is calculated as the mean of the four subscale scores, with higher scores indicating higher severity or frequency of ED behaviors. The Italian validation of the EDE showed satisfactory internal consistency (Cronbach's alpha values = 0.65-0.84), high inter-rater reliability (Spearman rho 0.93-0.99), and good criterion validity (Calugi et al., 2015).

The *Revised version of Symptom Checklist-90* (SCL-90-R) (Derogatis & Lazarus, 1994, Sarno et al., 2011) is a standardized self-report questionnaire designed to evaluate a range of psychopathological symptoms experienced over the last 7 days. It consists of 90 items, rated on a five-point Likert scale from 1 (Not at all)

to 5 (Extremely), grouped in the following subscales: Somatization, Obsessive–Compulsive, Interpersonal Sensitivity, Depression, Anxiety, Hostility, Phobic Anxiety, Paranoid Ideation, and Psychoticism. Consistent with the purpose of the study, the Depression and Anxiety subscales were considered, as these represent the most prevalent psychiatric comorbidities in the ED field, as reported in the aim section. The Italian version of the SCL-90-R showed good internal consistency (Cronbach's alpha values=0.70-0.96) (Prunas et al., 2012).

The Italian version of *Life Stressor Checklist-Revised* (Giannantonio, 2009) was developed to assess the lifetime presence of stressful or potentially traumatic events. The checklist includes 30 dichotomous items (yes/no) covering a range of adverse experiences such as natural disasters, physical or sexual assault, emotional neglect, death of a loved one, financial difficulties, and other life events. For each reported event, the current traumatic impact is evaluated by using the *Impact of Event Scale – Revised* (IES-R), a 22-item self-report questionnaire rated on a five-point Likert scale, ranging from 0 (not at all) to 4 (extremely). A score greater than or equal to 33 on the IES-R is considered indicative of potential post-traumatic stress disorder (PTSD) symptoms. In the present study, the variable 'trauma burden' referred to the total number of lifetime events for which the patient reported an IES-R score equal to or above the clinical cut-off, thereby reflecting the cumulative impact of traumatic experiences.

Statistical Analysis

The characteristics of patients were described by means (standard deviations) and percentages, depending on the nature of the variables. The ANPS subscales were utilized to identify homogeneous subgroups through conducting a Latent Profile Analysis (LPA) (Sinha et al., 2021). Initially, the data were assessed for outliers, and the distributions of the ANPS subscales were analyzed for deviations from normality and transformed (using logarithmic and square root methods), if needed, to achieve a more normal distribution. Every subscale was also standardized by converting it to z-scores. Following the selection of the model, a verification was executed on the 'local independence' assumption within the latent classes (correlation coefficients among observed variables less than 0.5).

The dataset revealed no missing data. Regarding the number of units, a simulation work conducted by Wurpts and Geiser (2014) found that models with fewer than 70 subjects were not feasible, and models based on samples of fewer than 100 should be interpreted with great caution; however, there is no definitive recommendation for the minimum sample size (Nylund-Gibson & Choi, 2018). Because of the limited sample size, the highest number of classes was set to 3. Parameters for each model were estimated using maximum likelihood, and fit statistics were produced. Furthermore, a posterior probability for membership in all latent classes of the model for individual observations was computed. After the models were fitted, the main indicators for identifying the most suitable model for the data included the Bayesian Information Criterion (BIC), the sample-size adjusted BIC (SABIC), and the Akaike Information Criterion (AIC). Lower values of these indices suggest a higher predictive accuracy. Alongside the fit of the indexing model, the Bootstrapped Likelihood Ratio Test (BLRT) was utilized to compare a k-class model against a (k-1)-class model. A significant p-value<0.05 indicates that the k-class model outperforms the (k-1)-class model. The relative size of the smallest latent class (2-classes model: a class <15% of the sample; 3-classes model: a class <10% of the sample) was examined. The validity of the 'latency' of the smallest classes was assessed by analyzing the main factors influencing class membership. Entropy, a measure of classification uncertainty, was calculated, with a value ≥0.80 corresponding to a robust group differentiation. Alongside the quantity of profiles, four models were defined based on how the variances and covariances of the variables are estimated: A) equal variances and fixed covariances at 0, B) varying variances and fixed covariances at 0, C) equal variances and equal covariances, and D) varying variances with varying covariances. Each of the combinations of class number and model configuration was estimated. In total, 8 models were fit (2-3 classes * 4 configurations). Selecting the model involved making decisions grounded in evidence from various sources, such as information criteria, statistical tests, and considerations of interpretability and simplicity. Subsequently, ANOVA with Bonferroni's post hoc test was conducted to explore the differences among the identified profiles in the patient's characteristics. Finally, a series of univariate multinomial regression

models was estimated to explore the strength of the association between each latent profile and each patient's characteristic. The analyses were performed using Jamovi Version 2.3.28, utilizing the 'tidyLPA' package for the Latent Profile Analysis, which offers an interface to the 'mclust' package for Gaussian Mixture Modeling.

3.3.3. Results of study 3

Description of the sample

A total sample of 128 ED outpatients satisfied the criteria for the data registry extraction. The ANPS distribution was inspected and outliers, defined as points that fall outside the Tukey's interval [Q_1-1.5*IQR, Q_3+1.5*IQR], were removed. A final sample of 122 patients was considered. Among the sample, 96.7% were females. The mean age of the sample was 26.4 years (SD=14.0; range=14-68). 42.6% of patients had a diagnosis of AN (44 (36.1%) patients with a diagnosis of AN-R subtype and 8 (6.5%) patients with a diagnosis of AN-BP subtype), 18.0% had a diagnosis of BN, 24.6% had a diagnosis of atypical AN, and 14.8% had a diagnosis of BED. BMI ranged from 11.7 kg/m^2 to 56.9 kg/m^2, with a mean value of 21.8 kg/m^2 (SD=8.1). 36.1% of patients were taking psychopharmacological medications at the time of psychodiagnostic assessment. Table 1 describes the socio-demographic and clinical characteristics of the sample.

Table 1. Socio-demographic and clinical characteristics of the sample (n=122)

		n	**%**
Age (years)[1]		26.4	(14.0)
Sex	Females	118	96.7
Employment	Student	70	57.4
	Employed	33	27.0
	Unemployed	19	15.6
Diagnosis	AN	52	42.6
	BN	22	18.0
	BED	18	14.8
	atypical AN	30	24.6
BMI (kg/m^2)[1]		21.8	(8.1)
Psychiatric comorbidity		39	32.0
Illness duration (years)[1]		8.9	(12.1)

[1]expressed as mean and (standard deviation); AN=Anorexia Nervosa; BN=Bulimia Nervosa; BED=Binge Eating Disorder; BMI=Body Mass Index.

Latent Profile Analysis

Table 2 shows the fit indices of the eight LPA models defined by how variances and covariances of the ANPS subscales were estimated and by the number of latent classes. Three models (1, 3, and 5) exhibited an unsatisfactory entropy value (0.66, 0.71, and 0.72, respectively), with model 5 also showing a non-significant BLRT (p=0.604). Models 6, 7, and 8 estimated a non-significant BLRT (p-value 0.446, 0.723, and 0.386, respectively). Finally, model 4 had a percentage of 7.4 as the relative size of the smallest latent class, which is below the admissible value of 10%. After a comprehensive evaluation of the fit indices, the three-profile model with equal variances and covariances fixed to 0 (model 2) was selected as the most suitable model for the sample.

Table 2. Model fit indices for the Latent Profile Analysis (n=122)

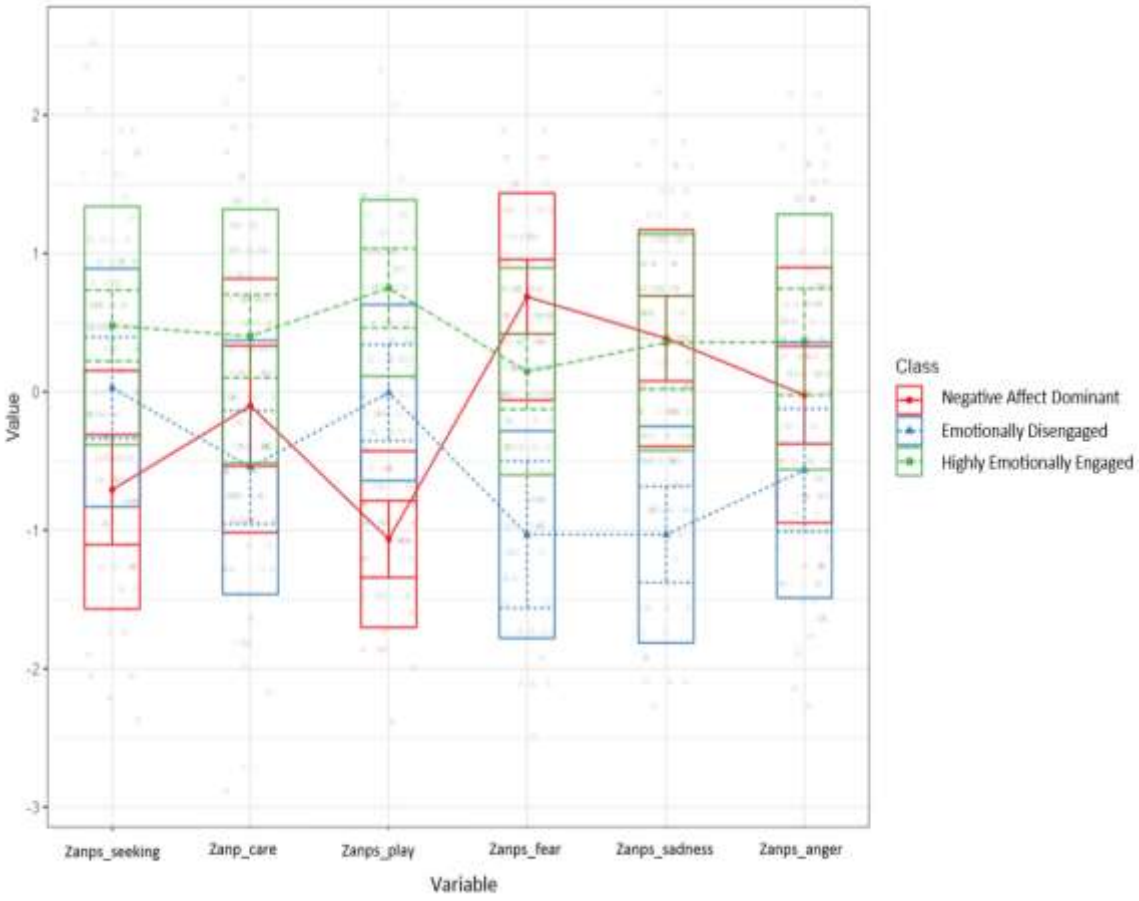
			Model fit indices					
Model	**Specification***	**Classes**	**BIC**	**SABIC**	**AIC**	**BLRT p-value**	**% Smallest latent class**	**Entropy**
1	A	2	2117.85	2057.78	2064.58	44.72 0.010	44.3	0.66
2	A	3	2084.83	2002.63	2011.93	66.65 0.010	26.2	0.77
3	B	2	2141.85	2062.85	2071.79	49.51 0.010	48.4	0.71
4	B	3	2165.45	2045.30	2058.90	38.89 0.040	7.4	0.80
5	C	2	2092.44	1984.94	1997.10	10.40 0.604	46.7	0.72
6	C	3	2113.07	1983.44	1998.11	13.00 0.446	11.5	0.79
7	D	2	2158.02	1984.12	2003.80	45.71 0.723	32.8	0.77
8	D	3	2231.23	1968.80	1998.50	61.30 0.386	12.3	0.89

* A = Equal variances and covariances fixed to 0; B = Varying variances and covariances fixed to 0; C = Equal variances and equal covariances; D = Varying variances and varying covariances;
BIC = Bayesian Information Criterion; SABIC = Sample-size Adjusted BIC; AIC = Akaike Information Criterion; BLRT = Bootstrapped Likelihood Ratio Test

Figure 1 shows the standardized mean scores of the three profiles across the ANPS dimensions. The first profile (P1), named 'Negative Affect Dominant', comprised 36 patients (29.5%) characterized by high levels of the 'Fear' and

‘Sadness’ dimensions and low levels of the ‘Play’ and ‘Seeking’ dimensions. The second profile (P2), named ‘Emotionally Disengaged’, consisted of 32 patients (26.2%), marked by low levels across all negative dimensions (i.e., ‘Fear’, ‘Sadness’, and ‘Anger’) and a low level of the ‘Care’ dimension. Finally, the third profile (P3), named ‘Highly Emotionally Engaged’, which included 54 patients (44.3%), was characterized by high levels of all the positive dimensions (i.e., ‘Seeking’, ‘Care’, and ‘Play’), along with elevated levels of the ‘Sadness’ and ‘Anger’ dimensions.

Figure 1. The latent profiles of ANPS dimensions (n=122)



Comparison of sociodemographic, clinical, and psychopathological characteristics among the three ANPS profiles

Comparisons of socio-demographic and clinical characteristics among the three profiles are reported in Table 3. No significant differences emerged in terms of employment (p=0.211), ED diagnosis (p=0.053), BMI (p=0.625), and psychiatric comorbidity (p=0.338). On the contrary, statistically significant differences emerged for sex (P1 and P3 were composed of 100% female patients, whereas P2 was composed of 87.5% female patients; p=0.003), illness duration and age (patients in P2 showed a longer illness duration and an older age compared to those in P3, but not compared to those in P1; p<0.001). Additionally, patients in P1 reported a higher trauma burden than those in P2, but not significantly higher than those in P3 (p=0.006). All EDE and SCL-90-R variables showed statistically significant differences among profiles (p<0.001), except for the EDE 'Dietary Restraint' subscale. Specifically, P1 patients reported higher scores on the SCL-90-R 'Depression' subscale compared to both other profiles. Conversely, patients in P2 exhibited lower scores on EDE subscales and SCL-90-R 'Anxiety' subscale compared to the other two profiles.

Table 3. Comparisons of latent profiles in sociodemographic, clinical and psychopathological variables (N=122)

		'Negative Affect Dominant' (P1) n=36 M (SD)	**'Emotionally Disengaged' (P2) n=32 M (SD)**	**'Highly Emotionally Engaged' (P3) n=54 M (SD)**	***X²***	***F***	***p***	**Post-hoc**
Age		27.06 (12.33)	34.09 (19.33)	21.43 (8.33)		7.877	**<.001**	2>3
Sex	Females (%)	36 (100.0)	28 (87.5)	54 (100.0)	11.63		**.003**	
Employment	Student (%)	18 (50.0)	15 (46.8)	37 (68.5)	5.844		.211	
	Employed (%)	10 (27.8)	11 (34.4)	12 (22.2)				
	Unemployed (%)	8 (22.2)	6 (18.8)	5 (9.3)				
Diagnosis	AN (%)	15 (41.7)	19 (59.4)	18 (33.3)	12.452		.053	
	BN (%)	5 (13.9)	2 (6.3)	15 (27.8)				
	BED (%)	7 (19.4)	6 (18.8)	5 (9.3)				
	Atypical AN (%)	9 (25.0)	5 (15.6)	16 (29.6)				
BMI		23.0 (9.7)	21.2 (9.5)	21.3 (5.8)		0.473	.625	
Illness duration		9.3 (11.3)	15.0 (17.3)	5.0 (5.8)		7.717	**<.001**	2>3
Psychiatric Comorbidity	Yes (%)	12 (33.3)	7 (21.9)	20 (37.0)	2.168		.338	
Trauma burden		2.91 (2.61)	1.13 (1.83)	1.75 (2.30)		5.309	**.006**	1>2
EDE	Dietary Restraint	3.51 (1.27)	3.09 (1.64)	3.78 (1.42)		2.220	.113	
	Eating Concern	3.60 (1.33)	2.26 (1.35)	3.47 (1.46)		9.637	**<.001**	2<1,3
	Weight Concern	4.33 (1.43)	3.03 (1.39)	3.95 (1.51)		7.137	**<.001**	2<1,3
	Body Shape Concern	4.75 (1.16)	3.52 (1.40)	4.37 (1.19)		8.532	**<.001**	2<1,3
	Total	3.96 (1.04)	2.97 (1.07)	3.92 (1.14)		9.229	**<.001**	2<1,3
SCL-90-R	Depression	73.86 (11.18)	62.31 (14.50)	66.92 (10.41)		8.285	**<.001**	1>2,3
	Anxiety	69.28 (9.79)	57.19 (12.84)	66.40 (12.11)		9.943	**<.001**	2<1,3
ANPS 2.4	Seeking (0-42)	19.19 (5.31)	24.38 (5.74)	27.06 (5.37)		22.534	**<.001**	1<2,3
	Care (0-42)	28.39 (6.29)	26.22 (4.55)	31.57 (4.77)		11.276	**<.001**	3>1,2
	Play (0-42)	13.64 (4.02)	22.38 (5.16)	27.85 (4.97)		96.228	**<.001**	1<2,3; 3>2
	Fear (0-42)	36.00 (3.41)	26.13 (3.78)	33.04 (3.78)		64.311	**<.001**	1>2,3; 3>2
	Sadness (0-42)	31.83 (4.46)	23.84 (4.48)	31.98 (4.29)		40.003	**<.001**	2<1,3
	Anger (0-42)	22.61 (7.90)	18.63 (6.16)	25.80 (7.77)		9.436	**<.001**	3>2

M=Mean; SD=Standard Deviation; P1= Profile 1; P2= Profile 2; P3= Profile 3; EDE=Eating Disorder Examination; SCL-90-R= Revised version of Symptom Checklist-90; ANPS=Affective Neuroscience Personality Scales; AN=Anorexia Nervosa; BN=Bulimia Nervosa; BED=Binge Eating Disorder

Association between clinical and psychopathological characteristics and profile membership

Univariate multinomial logistic regressions were conducted to explore the relationship between each clinical and psychopathological characteristic of interest and the profile membership, with P1 serving as the reference group. With respect to P1, a shorter duration of illness was significantly associated with membership in P3; a lower trauma burden and lower depression symptoms were associated with P2 and P3. Finally, lower anxiety symptoms and reduced ED severity were associated with P2. Detailed results are presented in Table 4.

Table 4. Univariate multinomial logistic regression models (n=122)

		P2 vs P1 N=32 OR (95% CI)	**P3 vs P1 N=54 OR (95% CI)**
Diagnosis	Atypical AN vs. AN	0.44 (0.12-1.59)	1.48 (0.51-4.30)
	BN vs. AN	0.32 (0.05-1.86)	2.50 (0.74-8.49)
	BED vs. AN	0.68 (0.19-2.44)	0.59 (0.16-2.27)
Illness duration		1.00 (0.99-1.00)	0.99 (0.98-1.00)*
Psychiatric comorbidity		0.56 (0.19-1.66)	1.18 (0.48-2.85)
BMI		0.97 (0.92-1.03)	0.98 (0.93-1.03)
Trauma burden		0.69 (0.52-0.90)*	0.83 (0.70-0.99)*
SCL-90-R	Depression	0.92 (0.88-0.96)**	0.95 (0.91-0.99)*
	Anxiety	0.92 (0.87-0.96)**	0.98 (0.94-1.02)
EDE	Total	0.46 (0.29-0.74)*	0.97 (0.63-1.48)

P1= Profile 1; P2= Profile 2; P3= Profile 3; AN=Anorexia Nervosa; BN=Bulimia Nervosa; BED=Binge Eating Disorder; SCL-90-5=Revised version of Symptom CheckList-90; EDE=Eating Disorder Examination; OR=Odd Ratio; CI=Confidence Interval; * p<.05; ** p<.001

3.3.4. Discussion of study 3

The current study represents a first effort to identify latent affective profiles within a clinical sample of ED individuals, employing the *Affective Neuroscience Personality Scales* 2.4 (ANPS 2.4; Davis & Panksepp, 2011). Findings revealed greater heterogeneity in patterns of primary emotional systems than initially expected. Three distinct affective profiles emerged, each defined by a unique balance between positive and negative primary emotional systems.

The 'Negative Affect Dominant' profile was characterized by higher levels of negative primary emotional systems - specifically FEAR and SADNESS - which usually promote inhibitory/avoidant behaviors, heightened anxiety, separation distress calls, and feelings of aloneness. Moreover, patients of this profile exhibited lower levels of positive primary emotional systems such as SEEKING and PLAY, which are typically involved in exploratory behaviors in both environmental and social contexts. This pattern referred to an imbalance between positive and negative primary emotional systems, which has been previously associated with psychiatrically relevant distress (Panksepp et al., 2006). In fact, this profile was uniquely associated with higher levels of depressive symptoms, in agreement with Montag and colleagues (2021) who reported a link between depressive tendencies, higher levels of SADNESS and FEAR and lower levels of SEEKING. The likelihood of belonging to this profile increased with greater trauma burden, consistent with the well-established association between traumatization and heightened negative affect (APA, 2022; Rabito-Alcon et al., 2021; DePierro et al., 2018), avoidance behaviors, diminished interest or pleasure in activities, and social withdrawal (APA, 2022). Overall, it has been widely recognized that traumatized individuals have impaired emotion regulation abilities (Rabito-Alcon et al., 2021; Villalta et al., 2018; Trottier et al., 2017), as neuroimaging studies have shown that childhood trauma may dysregulate the child's neurobiological systems, thereby reducing the individual's capacity to cope with subsequent stressful events throughout life (Giotakos et al., 2020).

The second profile, named 'Emotionally Disengaged', was characterized by lower levels across all negative primary emotional systems – namely, FEAR, SADNESS, and ANGER – as well as a reduced activation of the CARE system, a

positive emotional system associated with nurturance and caregiving behaviors. Notably, this profile appeared to reflect a general decreased activation of primary emotional systems, particularly those involved in the formation of attachment bonds (i.e., SADNESS and CARE) and those mediating defensive responses such as fight (i.e., ANGER) or flight (i.e., FEAR) behaviors. This profile emerged as the most distinct, associated with a lower severity of depressive-anxious symptoms and ED severity, except for restrictive symptom severity, which appeared comparable to the other profiles. In this group of patients, it could be hypothesized that dietary restriction plays a specific role in emotion regulation, possibly serving as a mean of control and reducing negative affect (Wong et al., 2024) or as a strategy to prevent the activation of dominance/submission systems (i.e., ANGER and FEAR) which typically drive individuals toward social comparison - a process that may, in turn, elicit feelings of inferiority in ED patients (Giacolini et al., 2024). Despite the reduced global symptom severity, patients of this profile tended to experience a more chronic course of ED. Previous research conducted by Davidsen and colleagues (2017) in a clinical sample of treatment-seeking individuals showed that ED patients with longer illness duration tend to report lower levels of perceived functional impairment compared to those with shorter illness duration. Initially, ED behaviors may be goal-directed and driven by the desire to lose weight; however, over time, they can shift into compulsive, stimulus-response habits (Guarda et al., 2015). These patterns may gradually consolidate into a stable equilibrium, contributing to the maintenance of the disorder (Speciani et al., 2021; Oldershaw et al., 2019; Oldershaw et al., 2015). As a result, in individuals with a long-course ED, eating-, weight-, and body shape-related concerns may become integrated into their daily routine and thus perceived as less disruptive (Davidsen et al., 2017). Therefore, milder symptoms as perceived by the patients may also reflect an adaptation process to the illness, potentially leading to feelings of resignation, as long-standing ED patients may not consider full recovery necessary to improve their quality of life (Cummings et al., 2023).

Finally, the ‘Highly Emotionally Engaged’ profile was marked by simultaneous activation of systems involved in attachment (i.e., SADNESS and CARE),

exploratory behaviors (i.e., SEEKING and PLAY), and fight responses (i.e., ANGER). This configuration may reflect a heightened emotional reactivity and a broad range of emotions, encompassing both positive and negative valence. As Liotti (2017) noted, the concurrent activation of attachment and defensive systems may signal an underlying attachment disorganization, which tends to be more evident when compensatory controlling strategies collapse in the face of overwhelming or distressing events. Therefore, examining internal working models of attachment of these patients could be particularly informative and warrants further investigation. However, this profile was also characterized by the activation of systems that promote approach-oriented behaviors and social-environmental exploration. This pattern may be partly explained by the younger age of these individuals - typically in adolescence or young adulthood - a developmental period in which the formation of interpersonal relationships outside the family becomes particularly salient. Patients of this profile exhibited intermediate levels of anxious-depressive symptoms, ED behaviors, and trauma burden and a shorter duration of illness, suggesting that they have been at an earlier stage of their ED compared to those in the other two profiles. Overall, this group appeared to display some characteristics, such as younger age, heightened emotional expression, and shorter illness duration, that have been previously associated with more favorable prognostic outcomes (Gautam et al., 2024; Austin et al., 2021; Errichiello et al., 2016). As a result, from a cost-effectiveness standpoint, patients characterized by this affective profile may particularly benefit from early intervention strategies, which could interrupt the progression of ED pathology, support recovery, and prevent more severe illness trajectories (Mills et al., 2024).

Our data could also be discussed in light of previous research on personality and temperamental profiles. The majority of the previous studies have explored which specific personality traits were associated with the severity and persistence of ED symptoms, rather than clustering traits into latent profiles (Hower et al., 2021; Atiye et al., 2015; Banos et al., 2014). When latent profiles were examined, three profile solutions were often identified (Lavender et al., 2013; Turner et al., 2014), and some studies observed associations between temperamental profiles and ED

diagnosis type (Krug et al., 2011). The absence of a significant association between ANPS profiles and ED diagnosis within our study could be due to the small sample size and diagnostically unbalanced sample, highlighting the need for larger samples.

Krug and colleagues (2011) found that personality profiles with high levels of harm avoidance (i.e., a temperamental trait characterized by inhibition, worrying, and fear of consequences) were associated with higher levels of ED symptoms. Similarly, in the current study, 'Highly Emotionally Engaged' and 'Negative Affect Dominant' profiles, both marked by high FEAR system activation, included patients with higher ED severity. This is also consistent with the results of Marzola and colleagues (2020), who highlighted the role of anxious temperament in ED severity.

In the ED field, personality and temperamental traits were mainly investigated through the administration of the Tridimensional Personality Questionnaire (TPQ) or Temperament and Character Personality (TCI), both based on the 'biosocial model of personality' (Cloninger et al., 1987). This model is distinct from the Affective Neuroscience theory developed by Panksepp (2006), which, drawing from evolutionary psychiatry, primarily conceives subcortical primary emotional systems as the evolutionarily oldest part of personality - shared with other mammalian species (Montag et al., 2021). Therefore, TPQ/TCI and ANPS 2.4 seem to capture neurobiologically shaped traits underlying personality development from different theoretical perspectives, even though correlations between Cloninger's traits and Panksepp's primary emotional systems have been reported (e.g., the correlation between the FEAR system and harm avoidance) (Montag et al., 2018; Panksepp et al., 2011; Cloninger et al., 1993).

Regarding illness duration, a lower level of cooperativeness has been found in chronically ED patients (Fassino et al., 2004; Bulik et al., 2000), consistent with the current findings of reduced levels of the CARE system in the profile associated with longer mean illness duration. In contrast with previous studies, which found higher harm avoidance in patients characterized by longer illness duration (Krug et al., 2011; Fassino et al., 2004), the current findings showed that the patients' subgroup with longer mean duration of illness (i.e., the 'Emotionally

Disengaged' profile) was prone to report lower levels of the FEAR system. This difference could be explained by sample features: the current study's 'Emotionally Disengaged' profile included all ED diagnosis types, in contrast to Bulik and colleagues (2000), whose sample included only AN patients. Moreover, the mean illness duration reported by the 'Emotionally Disengaged' profile was longer than reported by Krug and colleagues (2011). Thus, it is possible that Krug's (2011) sample captured earlier stages of the illness, whereas the current study's 'Emotionally Disengaged' profile may involve additional adaptation processes that could impact on personality expression, in accordance with the scar model of psychopathology (Wilson & Olino, 2021).

Overall, the key strength of this study lies in its adoption of Panksepp's Affective Neuroscience Theory - a framework that has not been applied yet to clinical samples with EDs. This approach tried to offer a novel perspective on the emotional functioning of patients with ED diagnoses, an aspect often overlooked in previous research (Treasure et al., 2012). Additionally, the use of a person-centered methodology enabled the identification of distinct empirically derived affective patterns based on the unique configuration of primary emotional systems in each patient.

Nonetheless, the study has several limitations that should be considered. First, the relatively small sample size limits the generalizability of the findings and supports only an exploratory approach. Therefore, the results should be interpreted with caution, and future research with larger samples is needed. Second, the majority of patients were diagnosed with AN, which reduces the applicability of results to the broader ED population; further research should aim to include individuals with other ED subtypes. Another limitation is the lack of control for potential confounding factors in the association between the ANPS latent profiles and ED severity. This is particularly evident for depressive symptoms, which have been commonly associated with higher activation of negative primary emotional systems (Montag et al., 2021) and higher ED severity (Sander et al., 2021). Nevertheless, within the Affective Neuroscience framework (Panksepp, 1998), depressive symptoms may also be conceptualized as potential outcomes of specific patterns of primary emotional systems activation, which were the focus of

the present study. Ultimately, the study relied exclusively on self-report measures, which may have introduced social desirability and recall biases. In addition, assessing affective dimensions through self-report measures can be particularly challenging in the ED population, who often display high levels of cognitive control and emotional suppression, potentially compromising the accurate reporting of emotional experiences. Future research would benefit from the inclusion of multimethod and multi-informant assessments to achieve a more comprehensive understanding of emotional functioning in individuals with EDs.

3.3.5. Conclusion of study 3

Although emotional difficulties are widely recognized as significant risk factors in the development and maintenance of EDs (Trompeter et al., 2021; Treasure & Schmidt, 2013), research exploring distinct affective patterns among ED individuals remains limited. The present study draws on the Affective Neuroscience framework, which conceptualizes primary emotional systems as core emotional endophenotypes relevant to the understanding of psychiatric disorders (Panksepp, 2006). These systems operate along a dimensional continuum of activation, shaped by the dynamic interaction between brain and environment (Brienza et al., 2023).

Employing a person-centered approach, this study highlights the heterogeneity of affective patterns within the ED population by treating the individual as the unit of analysis. Unlike variable-centered approaches - which assume sample homogeneity and examine averaged associations across the sample - a person-centered approach enables the identification of distinct emotional profiles based on the specific configuration of primary emotional systems in each patient. Through this method, three distinct subgroups of ED patients were identified, each characterized by a specific empirically derived affective pattern. Notably, these affective profiles did not align with ED diagnostic subtypes but were instead associated with other clinical variables such as illness duration, trauma burden, ED severity, and depressive symptomatology. These findings underscore the importance of considering individual differences in affective functioning when designing and implementing ED interventions, as they may inform more tailored

treatment approaches. Emotion-focused interventions such as Cognitive Remediation and Emotional Skills Training (CREST; Tchanturia et al., 2015) and Emotionally Focused Therapy (EFT) (Greenberg, 2011; Hibbs et al., 2021) have already been introduced in the ED field; however, further research is needed to evaluate their effectiveness across different affective profiles. Future studies should also investigate the role of primary emotional systems in the onset, maintenance, and treatment response of EDs, with the goal of contributing to the development of emotion-informed care models for the ED population.

4. CONCLUSION

4.1. Summary of findings

Altogether, these studies provided efforts to address the existing gaps in the literature regarding the key mechanisms underlying the ED psychopathology. The findings support the multidimensional nature of EDs, emphasizing the involvement of a wide range of psychological processes that extend beyond the observable ED symptoms.

In particular, EMS appeared to play a mediating role in the well-established relationship between childhood trauma and the current severity of ED symptoms. As enduring and pervasive cognitive-affective structures - reflecting dysfunctional beliefs about the self, others, and the world - EMS develop through early relational experiences and may continue to shape the individual's emotional and behavioral functioning into adulthood. These findings highlight the need to consider EMS as a therapeutic target, particularly in the treatment of ED patients who have a history of childhood trauma.

Furthermore, the results indicated that emotional functioning is also distinctly altered in ED patients. The affective profiles of individuals with EDs, conceptualized in terms of the activation patterns of primary emotional systems as described by Panksepp's affective neuroscience model, appeared to vary according to specific clinical characteristics such as illness duration, trauma burden, and age. This suggests that different patterns of primary emotional systems may contribute to the high heterogeneity observed across ED clinical presentations.

Finally, these findings highlighted the relevance of body experience in ED psychopathology, according to the theoretical framework of the Allocentric Lock Theory. Distorted third-person representation of one's body, resulting from a shift from an embodied, first-person body experience toward a self-representation from an external point of view, contributes to unpleasant emotional states. Clinical empirical evidence further suggested that restrictive symptom severity and related risk factors - such as asceticism and emotion dysregulation - were higher among individuals who simultaneously exhibited difficulties in perceiving internal bodily

signals (interoceptive deficits) and recollection of appearance-related feedback from others received prior to the ED onset. This pattern supports the concept that altered body experience can emerge from the co-occurrence of altered bottom-up interoceptive processes and external, socially mediated evaluative processes.

Taken together, these findings suggest that early maladaptive schemas, unbalanced affective profiles, and altered body experience may act as transdiagnostic mechanisms across different types of EDs, rather than being specifically linked to a single ED diagnosis.

4.2. Strengths and limitations

Strengths

The thesis project presented both strengths and limitations. Among its main strengths, one of the most relevant concerns the use of data derived from a clinical registry containing recent and representative data of the ED outpatients from the Verona area. Data extraction from this registry provided the opportunity to analyze specific clinical characteristics and psychological variables that have been relatively underexplored in previous research, using data derived from real-world clinical samples. Furthermore, the application of various statistical techniques - such as mediation analysis, regression analysis, and latent profile analysis - allowed for the examination of associations between ED psychopathology and relevant clinical features from different methodological perspectives.

Additionally, the integration of theoretical frameworks that are relatively new or less frequently applied within the ED field, such as the Schema Therapy model, or those deriving from neuroscientific disciplines (i.e., the Allocentric Lock Theory and Panksepp's Affective Neuroscience model), offers a broader and deeper understanding of ED psychopathology. This interdisciplinary approach may represent a further step toward an interesting dialogue between basic scientific research and clinical research, an integration that has already been recognized as necessary by some authors (Phillipou et al., 2025; Jansen, 2016) for the advancement of research in the ED field.

Limitations

The thesis project also presented several limitations. First, the clinical sample size considered in each study was relatively small. This limitation is partly attributable to the fact that some of the instruments used to collect data on relevant psychological factors - such as the *Word Count Questionnaire* (WCQ), employed to assess self-reported appearance-related comments from others (in Study 2), and the *Affective Neuroscience Personality Scales* (ANPS 2.4), used to examine primary emotional systems (in Study 3) - were introduced only in more recent years and were therefore not available since the initial data systematization phase of the Centre's registry in 2014-2022. On the contrary, Young Schema

Questionnaire (in Study 1) was removed from the set of assessment instruments in 2017 due to its long administration time, therefore data have not been available since 2017. In addition, the adoption of restrictive exclusion criteria, such as the exclusion of participants with psychiatric comorbidities (in Study 1), has reduced the number of eligible cases.

Another limitation relates to the characteristics of the clinical population who arrived at the Regional Centre for Feeding and Eating Disorders. Most outpatients accessing the Centre typically present with long-standing forms of ED, often after having sought treatment from other healthcare professionals or facilities. Consequently, examinations of features associated with newly diagnosed or early-stage ED cases were rare. Moreover, the absence of a healthy control group or another comparison clinical group did not allow to determine whether the observed results were specifically associated with eating pathology.

Moreover, the research designs adopted in the present studies do not allow for the establishment of causal inferences among variables or a prospective assessment of disorder outcomes; therefore, the temporal direction of the association between variables could not be determined. Future studies employing longitudinal designs may be particularly relevant, as they allow for the monitoring of ED patients over time and provide insights into the symptomatic trajectories and developmental pathways that characterize different clinical presentations of EDs.

Finally, the studies included in this thesis are based on self-report measures. Although such instruments provide information about the patient's subjective perception of mental distress, they are also affected by sources of bias, including social desirability and recall bias. These limitations are particularly relevant in the case of individuals with AN, who may exhibit denial or minimization of their symptoms due to the egosyntonic nature of the disorder (Starzomska & Tadeusiewicz, 2016) and their high levels of cognitive control (Treasure et al., 2020).

4.3. Implications for Research and Clinical Practice

The results of these empirical studies may have several implications for the field of EDs in terms of scientific research and clinical practice.

First of all, the findings provide insights into the potential underlying psychological mechanisms that could inform the development of future transdiagnostic, mechanism-based models and mechanism-based subtyping within ED populations. Investigating the altered mechanisms underlying each individual functioning - beyond the observable symptoms - is essential to identify appropriate treatment targets, prevent diagnostic cross-over, and avoid the siloing of the psychotherapeutic work in highly complex cases characterized by multiple comorbid disorders. This is consistent with the principles of personalization of care, an emerging paradigm that seeks to move beyond one-size-fits-all approaches to mental health (van Dellen, 2024). By focusing on individual variability in biological, psychological, and behavioral processes, the paradigm of 'personalization of care' aims to guide personalized clinical decisions, optimize treatment allocation, improve prognosis, and promote better clinical outcomes.

In the context of ED psychopathology, achieving this goal may be particularly complex due to the multidimensional nature of the disorder, which simultaneously involves psychological, physiological, and behavioral dimensions that interact with each other. Nevertheless, as research has not identified a clearly superior treatment approach for some EDs (i.e., anorexia nervosa), the need for new paradigms to move the field beyond its current treatment limitations is particularly compelling (Kan et al., 2018). Consequently, clinical practice should include systematic routine clinical outcome measures, obtained through multi-method assessment strategies that integrate different types of data - psychological, biological, anthropometric, behavioral, and nutritional - and continuously monitor their dynamic interactions over time. Such integrative assessments could contribute to a more comprehensive understanding of ED pathology, treatment response, and relapse risk.

Furthermore, clinical evaluation practice should also adopt a multi-informant perspective, incorporating the viewpoints of patients, clinicians, caregivers, and researchers to capture the full spectrum of experiences associated with EDs. This

approach may also be essential for identifying current challenges, strengths, and limitations within the organizational processes of Eating Disorder Services, as well as pitfalls in the interfaces with other mental health and nutritional services. It also helps uncover treatment-seeking barriers that hinder the early detection of ED cases. These multi-informant inputs may provide guidance for health policy decision-makers and inform public health strategies, facilitating their alignment with the complexity of real-world clinical settings. Future research directions should consider greater dialogue with clinical practice, even through the use of routine clinical outcome measures within ED services. In line with this perspective, the present doctoral thesis aimed to follow this direction, promoting closer integration between research and clinical practice.

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6. APPENDIX

Table 1.A. Results of the mediation analyses for all 18 EMSs

YSQ EMS	Direct effect c^1	*p* value	Mediated effect c-c^1	*p* value	*a*	*p* value	*b*	*p* value
Emotional deprivation	12.93	.028	2.97	.210	1.69	.094	1.76	.179
Abandonment	13.57	.029	2.33	.260	2.47	.079	0.94	.233
Mistrust/abuse	14.69	.014	1.22	.555	0.63	.543	1.93	.062
Social isolation	13.19	.021	2.72	.179	1.56	.152	1.74	.072
Defectiveness/shame	9.88	.106	6.02	.057	4.04	.004	1.49	.016
Failure	10.05	.101	5.85	.051	2.25	.017	2.59	.003
Dependence	13.71	.036	2.19	.324	2.13	.069	1.03	.267
Vulnerability	14.25	.020	1.66	.428	1.87	.076	0.89	.476
Enmeshment	14.58	.015	1.32	.550	0.94	.555	1.41	.550
Subjugation	13.66	.020	1.59	.336	1.13	.331	1.41	.106
Self-sacrifice	15.85	.007	0.05	.974	0.06	.974	0.87	.132
Emotional inhibition	15.71	.008	0.19	.879	0.90	.293	0.21	.884
Unrelenting standards	15.88	.002	0.02	.666	0.01	.986	2.38	.005
Entitlement	15.89	.009	0.01	.930	0.06	.956	0.18	.928
Insufficient self-control	14.07	.015	1.83	.363	2.56	.033	0.71	.363
Approval-seeking	15.03	.009	0.87	.637	0.61	.617	1.44	.053
Negativity	11.38	.053	4.52	.112	2.48	.022	1.83	.017
Punitiveness	13.70	.024	2.20	.216	1.61	.154	1.37	.118

YSQ = Young Schema Questionnaire; EMS = Early Maladaptive Schema; Childhood trauma burden as independent variable (IV), EDI-3-EDRC as dependent variable (DV), and each of the YSQ EMSs as mediator (MV). Total effect $c = 15.90$, $p = .007$; *a*: effect of IV on MV; *b*: effect of MV on DV

WORDS COUNT QUESTIONNAIRE

1. Have you ever received comments about your eating habits (e.g., how much, what, or how you eat)?

☐ Yes ☐ No

If yes, who made those comments?

_____
_____

How old were you when you first received those comments?

_____
_____

For how long did you receive those comments?

_____
_____

What specific words do you remember from those comments?

_____
_____

At the time, how distressing was it to receive those comments?

1	2	3	4	5
Not at all		Moderately		Extremely

When you think back to those comments now, how distressing do they still feel?

1	2	3	4	5
Not at all		Moderately		Extremely

2. Have you ever received comments about your weight, body shape, physical appearance?

☐ Yes ☐ No

If yes, who made those comments?

_____
_____

How old were you when you first received those comments?

_____
_____

For how long did you receive those comments?

_____
_____

What specific words do you remember from those comments?

_____
_____

At the time, how distressing was it to receive those comments?

1 2 3 4 5
Not at all Moderately Extremely

When you think back to those comments now, how distressing do they still feel?

1 2 3 4 5
Not at all Moderately Extremely

3. Have you ever received unpleasant comments about yourself as a person (e.g., your self-worth, abilities, or performance)?

☐ Yes ☐ No

If yes, who made those comments?

_____
_____

How old were you when you first received those comments?

_____
_____

For how long did you receive those comments?

_____
_____

What specific words do you remember from those comments?

_____
_____

At the time, how distressing was it to receive those comments?

1	2	3	4	5
Not at all		Moderately		Extremely

When you think back to those comments now, how distressing do they still feel?

1	2	3	4	5
Not at all		Moderately		Extremely

Table 2.A. Internal consistency (Cronbach's Alpha values) for each subscale in the current study sample (n=89)

		Cronbach's Alpha
EDI-3	Drive for Thinness	0.91
	Bulimia	0.89
	Body Dissatisfaction	0.82
	Eating Disorder Risk Composite (EDRC)	0.91
	Low Self-Esteem	0.87
	Personal Alienation	0.76
	Interpersonal Insecurity	0.86
	Interpersonal Alienation	0.77
	Interoceptive Deficits	0.86
	Emotion Dysregulation	0.74
	Perfectionism	0.67
	Asceticism	0.81
	Maturity Fears	0.82
EDE	Dietary Restraint	0.73
	Eating Concern	0.68
	Weight Concern	0.66
	Shape Concern	0.79
	Total	0.87
SCL-90-R	Somatization	0.85
	Obsessive-Compulsive	0.79
	Interpersonal Sensitivity	0.82
	Depression	0.87
	Anxiety	0.86
	Hostility	0.78
	Phobic Anxiety	0.78
	Paranoid Ideation	0.67
	Psychoticism	0.77
	Global Severity Index	0.96