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Identifying Affective Patterns in Patients With Eating Disorders: A Latent Profile Analysis

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ABSTRACT

Background: Emotional difficulties are common among individuals with Eating Disorders (EDs). Following Panksepp's theoretical model, which conceptualises primary emotional systems as the evolutionary foundation of personality, this study aimed to identify distinct profiles of primary emotional systems within a clinical eating disorder (ED) sample. It further examined differences in sociodemographic, clinical, and psychopathological characteristics across profiles, as well as associations between clinical features and profile membership.

Methods: In this cross-sectional study, data were obtained from the Regional Centre for ED registry at the University Hospital of Verona. Measures included the Affective Neuroscience Personality scales, the Eating Disorder Examination, the Symptom CheckList-90-Revised, the Life Stressor Checklist-Revised, and the Impact of Event Scale-Revised. A Latent Profile Analysis was conducted, followed by inferential analyses.

Results: Among 122 patients, three profiles emerged: (1) high FEAR and SADNESS, and low SEEKING and PLAY; (2) low negative primary emotional systems and CARE; (3) high positive primary emotional systems and high SADNESS and ANGER. Profiles differed by age, sex, illness duration, trauma burden, depressive-anxiety symptoms, and ED severity.

Discussion: Findings revealed emotional heterogeneity among ED patients, underscoring the importance of considering individual emotional differences in treatment planning. Study limitations and directions for future research are discussed.

1 | Introduction

Eating Disorders (EDs) are severe mental disorders characterised by disturbance in eating behaviours, medical complications, and low quality of life, with a lifetime prevalence from 2% to 5% (Attia and Walsh 2025). The Diagnostic and Statistical Manual of Mental Disorders, fifth edition, Text Revision (DSM-

5-TR; American Psychiatric Association 2022) categorises EDs into the following diagnostic groups: Anorexia Nervosa (AN), 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

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Highlights

- Three distinct affective profiles emerged, suggesting a heterogeneity in patterns of primary emotional systems among patients with eating disorders.
- Affective profiles did not associate with eating disorder diagnosis but with other clinical variables such as illness duration, trauma burden, eating symptoms severity, and depressive symptomatology.
- A chronic course of the eating disorder was associated with a deactivation of negative primary systems, whereas the activation of both positive and negative primary systems was associated with more favourable prognostic factors such as a shorter course of illness and younger age.

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. 2017), 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 and 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 behaviours 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 et al. (2021) identified distinct emotion control styles across ED diagnoses, distinguishing between an undercontrolled/dysregulated profile—characterised by high impulsivity and emotional expression—predominantly associated with BN and binge-eating symptoms, and an over-controlled/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). In line with this perspective, individual differences in emotional reactivity and emotion regulation have been associated with temperamental traits (Gross 2013), which have been widely investigated in the ED literature (Atiye et al. 2015). Studies using the Temperament and Character Personality (TCI) questionnaire, based on Cloninger's 'Biosocial Model of Personality'

(Cloninger 1987), showed that persistence trait has been commonly associated with all EDs, whereas other temperamental traits were more disorder-specific, such as harm avoidance in AN and novelty seeking in BN (Atiye et al. 2015). Alongside these findings, some studies have investigated affective temperaments—conceptualised as biologically based sub-affective trait expressions that shape emotions, cognitions, and actions (Marzola et al. 2017, 2020)—highlighting the role of anxious temperament in EDs (Marzola et al. 2020).

Complementing these personality-based approaches and drawing on neurobiological and evolutionary findings, Panksepp (2006) developed a model of primary emotional systems which 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 behaviour and emotional responses (Montag and Panksepp 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 (2006) are the following (capitalization is used as in the original article): (1) CARE—promotes nurturance behaviour and sensitivity to newborn babies and puppies, facilitating attachment bonding; (2) SADNESS—organizes the alarm behaviours 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 behaviours, 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 behaviours, 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 behaviour and motivation to get resources from the environment (Panksepp 2006; Panksepp and Biven 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 behaviours (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 and 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 et al. (2024) have analysed 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. Moreover, the use of ANPS 2.4 could provide insight into the role of 'CARE' and 'PLAY' systems, which have a unique role within Panksepp's model (2006), and have received less attention in the ED literature compared to negative affectivity (Trompeter et al. 2021; Lavender et al. 2015).

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-centred 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 and 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 hypothesised—based on previous literature (Isaksson et al. 2021)—the presence of one profile characterised 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.

2 | Methods

2.1 | 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).

2.2 | 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 (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 organised 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 behaviours as directly as possible (e.g., 'I sometimes cannot stop worrying about my problems') rather than cognitive judgements (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 and Fairburn 1987; Calugi et al. 2015) is a semi-structured clinical interview designed to assess the range and the severity of ED behaviours 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 behaviours. 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 et al. 1994; Prunas et al. 2012) 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: Somatisation, 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.

2.3 | 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 utilised to identify homogeneous subgroups through conducting a Latent Profile Analysis (LPA) (Sinha et al. 2021). As outlined by Sinha et al. (2021), initially, the data were assessed for outliers (due to the fact that these models can be sensitive to extreme values), and the distributions of the ANPS subscales were analysed 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 and 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 utilised 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 analysing 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 (two to three 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. A multivariate analysis was conducted for purely exploratory purposes, including only predictors significant in univariate multinomial regression models. Moreover, a sensitivity analysis was conducted by re-running the Latent Profile Analysis after having excluded from the sample the four males (*n* = 118). The analyses were performed using Jamovi Version 2.3.28, utilising the ‘tidyLPA’ package for the Latent Profile Analysis, which offers an interface to the ‘mclust’ package for Gaussian Mixture Modelling.

3 | Results

3.1 | Description of the Sample

A total sample of 128 ED outpatients satisfied the criteria for the data registry extraction. Each ANPS subscale 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. In detail, one patient had the minimum value on the seeking subscale (3.00), and one on the care subscale (11.00); four patients were excluded because they had the minimum values on the fear subscale (12.00, 15.00, 17.00, and 18.00). 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, 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/m² to 56.9 kg/m², with a mean value of 21.8 kg/m² (*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.

3.2 | 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. The sensitivity analysis conducted after having excluded the four males indicated the model with the 3 classes and equal variances and covariance fixed to 0 was still the best (results are presented in Supporting Information S1; Table 1A of the Appendix).

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%) characterised 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 characterised by high levels of all the positive dimensions (i.e., 'Seeking', 'Care', and 'Play'), along with elevated levels of the 'Sadness' and 'Anger' dimensions.

3.3 | 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

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

		<i>n</i>	%
Age (years) ^a		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) ^a		21.8	(8.1)
Psychiatric comorbidity		39	32.0
Illness duration (years) ^a		8.9	(12.1)

Abbreviations: AN = Anorexia Nervosa; BED = Binge Eating Disorder; BMI = Body Mass Index; BN = Bulimia Nervosa.

^aExpressed as mean and (standard deviation).

TABLE 2 | Model fit indices for the latent profile analysis ($n = 122$).

Model	Specification ^a	Classes	Model fit indices					
			BIC	SABIC	AIC	BLRT <i>p</i> -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

Abbreviations: AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; BLRT, Bootstrapped Likelihood Ratio Test; SABIC, Sample-size Adjusted BIC.

^aA 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.

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.

3.4 | 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. A multivariate multinomial logistic regression model with predictors significant in univariate multinomial logistic regression models was reported in Supporting Information S1; Table 2A in the Appendix.

4 | Discussion

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 and 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.

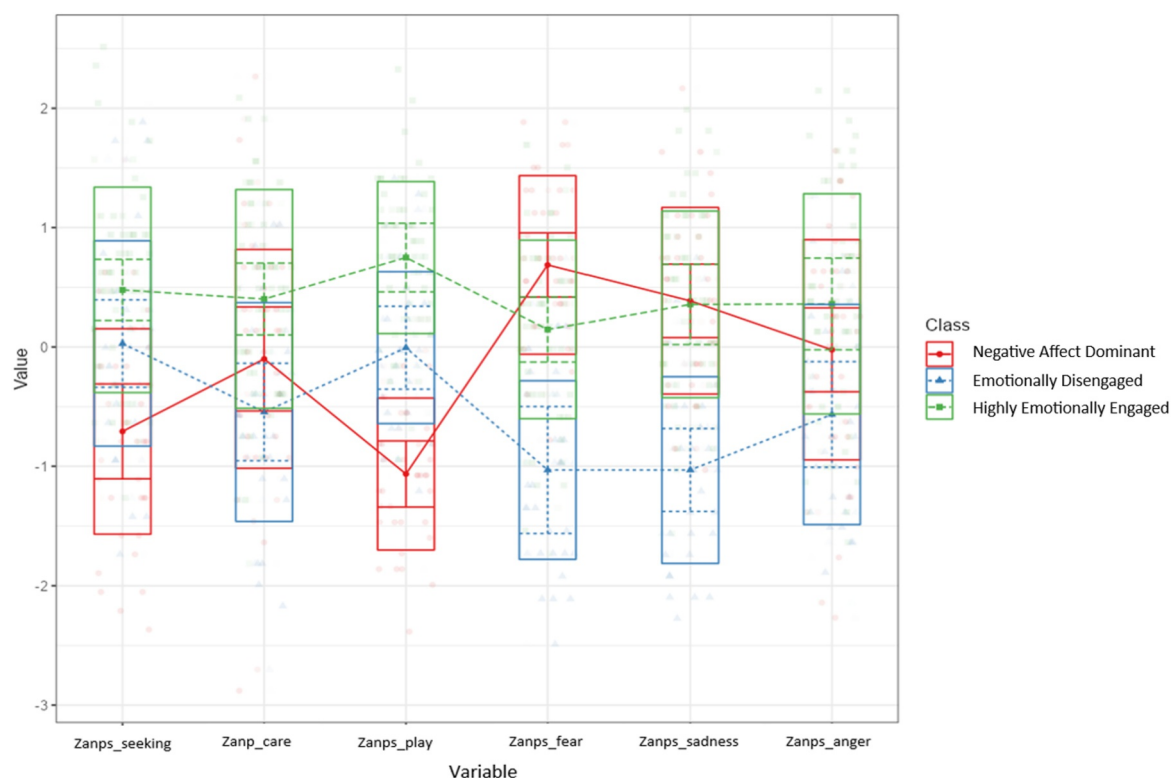


FIGURE 1 | The latent profiles of ANPS dimensions ($n = 122$). The variables indicated on the x-axis represent z-scores of the six primary emotional systems.

The ‘Negative Affect Dominant’ profile was characterised by relatively higher levels of negative primary emotional systems—specifically FEAR and SADNESS—which usually promote inhibitory/avoidant behaviours, heightened anxiety, separation distress calls, and feelings of aloneness. Moreover, patients of this profile tended to exhibit lower levels of positive primary emotional systems such as SEEKING and PLAY, which are typically involved in exploratory behaviours in both environmental and social contexts. This pattern may reflect an imbalance between positive and negative primary emotional systems, which has been previously associated with psychiatrically relevant distress (Panksepp 2006). In fact, this profile was associated with higher levels of depressive symptoms, consistent with Montag et al. (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 appeared to increase with greater trauma burden, consistent with the well-established association between traumatisation and heightened negative affect (American Psychiatric Association 2022; Rabito-Alcon et al. 2021; DePierro et al. 2018), avoidance behaviours, diminished interest or pleasure in activities, and social withdrawal (American Psychiatric Association 2022). Overall, it has been widely recognized that traumatised individuals have impaired emotion regulation abilities (Rabito-Alcon et al. 2021; Villalta et al. 2018; Trottier and MacDonald 2017), as neuro-imaging 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 2020).

The second profile, named ‘Emotionally Disengaged’, was characterised 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 behaviours. This profile may 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) behaviours. This profile emerged as the most distinct and was associated with a lower severity of depressive-anxious symptoms and ED severity, while restrictive symptom severity appeared comparable to the other profiles. In this group of patients, it could be hypothesised 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 towards 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 in this profile were older, although the mean age of ED onset was similar to that of other profiles. As a consequence, this profile appeared to be associated with a more chronic course of ED. Previous research conducted by Davidsen et al. (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 a shorter illness duration. Initially, ED behaviours 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

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)	X^2	F	p	Post- hoc
Age		27.06 (12.33)	34.09 (19.33)	21.43 (8.33)		7.877	< 0.001	2 > 3
Sex	Females (%)	36 (100.0)	28 (87.5)	54 (100.0)	11.63		0.003	
Employment	Student (%)	18 (50.0)	15 (46.8)	37 (68.5)	5.844		0.211	
	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		0.053	
	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)				
Age of ED onset		17.36 (7.86)	18.22 (9.24)	16.41		0.547	0.582	
BMI		23.0 (9.7)	21.2 (9.5)	21.3 (5.8)		0.473	0.625	
Illness duration		9.3 (11.3)	15.0 (17.3)	5.0 (5.8)		7.717	< 0.001	2 > 3
Psychiatric comorbidity	Yes (%)	12 (33.3)	7 (21.9)	20 (37.0)	2.168		0.338	
Trauma burden		2.91 (2.61)	1.13 (1.83)	1.75 (2.30)		5.309	0.006	1 > 2
EDE	Dietary restraint	3.51 (1.27)	3.09 (1.64)	3.78 (1.42)		2.220	0.113	
	Eating concern	3.60 (1.33)	2.26 (1.35)	3.47 (1.46)		9.637	< 0.001	2 < 1.3
	Weight concern	4.33 (1.43)	3.03 (1.39)	3.95 (1.51)		7.137	< 0.001	2 < 1.3
	Body shape concern	4.75 (1.16)	3.52 (1.40)	4.37 (1.19)		8.532	< 0.001	2 < 1.3
	Total	3.96 (1.04)	2.97 (1.07)	3.92 (1.14)		9.229	< 0.001	2 < 1.3
SCL-90-R	Depression	73.86 (11.18)	62.31 (14.50)	66.92 (10.41)		8.285	< 0.001	1 > 2.3
	Anxiety	69.28 (9.79)	57.19 (12.84)	66.40 (12.11)		9.943	< 0.001	2 < 1.3
ANPS 2.4	Seeking (0–42)	19.19 (5.31)	24.38 (5.74)	27.06 (5.37)		22.534	< 0.001	1 < 2.3
	Care (0–42)	28.39 (6.29)	26.22 (4.55)	31.57 (4.77)		11.276	< 0.001	3 > 1.2
	Play (0–42)	13.64 (4.02)	22.38 (5.16)	27.85 (4.97)		96.228	< 0.001	1 < 2.3; 3 > 2
	Fear (0–42)	36.00 (3.41)	26.13 (3.78)	33.04 (3.78)		64.311	< 0.001	1 > 2.3; 3 > 2
	Sadness (0–42)	31.83 (4.46)	23.84 (4.48)	31.98 (4.29)		40.003	< 0.001	2 < 1.3
	Anger (0–42)	22.61 (7.90)	18.63 (6.16)	25.80 (7.77)		9.436	< 0.001	3 > 2

Note: Bold values indicate $p < 0.05$.

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

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).

Finally, the 'Highly Emotionally Engaged' profile was characterised by simultaneous activation of systems involved in attachment (i.e., SADNESS and CARE), exploratory behaviours (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 has been proposed as potentially indicative of underlying attachment disorganisation, which tends to be more evident when compensatory controlling strategies are challenged 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 characterised by the activation of systems that promote approach-oriented behaviours and social-environmental exploration. This pattern may be partly related to the younger age of these individuals—typically in adolescence or young adulthood—a developmental period in which the formation of interpersonal

TABLE 4 | Univariate multinomial logistic regression models ($n = 122$).

		P2 versus P1 $N = 32$ OR (95% CI)	P3 versus P1 $N = 54$ OR (95% CI)
Diagnosis	Atypical AN versus AN	0.44 (0.12–1.59)	1.48 (0.51–4.30)
	BN versus AN	0.32 (0.05–1.86)	2.50 (0.74–8.49)
	BED versus 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)

Abbreviations: AN = Anorexia Nervosa; BED = Binge Eating Disorder; BN = Bulimia Nervosa; CI = Confidence Interval; EDE = Eating Disorder Examination; OR = Odd Ratio; P1 = Profile 1; P2 = Profile 2; P3 = Profile 3; SCL-90-5 = Revised version of Symptom Checklist-90.

* $p < 0.05$.

** $p < 0.001$.

relationships outside the family becomes particularly salient. Patients of this profile exhibited intermediate levels of anxious-depressive symptoms, ED behaviours, and trauma burden and a shorter duration of illness, which may suggest a relatively earlier stage of 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 favourable prognostic indicators (Gautam et al. 2024; Austin et al. 2021; Errichiello et al. 2016). As a result, from a cost-effectiveness standpoint, patients characterised by this affective profile may particularly benefit from early intervention strategies, which might help limit the progression of ED pathology, support recovery, and reduce the likelihood of more severe illness trajectories (Mills et al. 2024).

These results could also be discussed in the light of previous literature on temperament traits (Marzola et al. 2020; Krug et al. 2011). 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. Moreover, high levels of harm avoidance have been associated with greater ED symptoms (Krug et al. 2011). Similarly, in the current study, ‘Highly Emotionally Engaged’ and ‘Negative Affect Dominant’ profiles, both characterised by high FEAR system activation, included patients with higher ED severity. This is also consistent with the results of Marzola et al. (2020), who highlighted the role of anxious temperament in ED severity.

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 attempted to offer a novel perspective on the emotional functioning of patients with ED diagnoses, an aspect often overlooked in previous research (Treasure, 2012). Additionally, the use of a person-centred 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 generalisability of the findings and supports only an exploratory approach, as well as reduces the possibility of estimating robust and reliable multivariate models. 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. Moreover, the LPA did not include covariates (e.g., age), which may limit the applicability of the resulting profiles. Another limitation concerns the reliance 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.

5 | Conclusion

Although emotional difficulties are widely recognized as significant risk factors in the development and maintenance of EDs (Trompeter et al. 2021; Treasure and Schmidt 2013), research exploring distinct affective patterns among ED individuals remains limited. The present study draws on the Affective Neuroscience framework, which conceptualises 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-centred approach, this study sought to capture the heterogeneity of affective patterns within the ED population by treating the individual as the unit of analysis.

Unlike variable-centred approaches—which assume sample homogeneity and examine averaged associations across the sample—a person-centred 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 characterised by a specific empirically derived affective pattern. Notably, these affective profiles did not appear to be aligned 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 suggest 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.

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Ethics Statement

This study received ethical approval (CESC Protocol number 48455, 8th August 2022). This study adhered to the Helsinki Declaration.

Consent

Informed consent was obtained from all participants enrolled in the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

Supporting Information S1: erv70154-sup-0001-suppl-data.docx.