



# Dissociative experiences of compartmentalization are associated with food addiction symptoms: results from a cross-sectional report

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## Abstract

**Purpose** Studies have shown significant associations of dissociative symptoms with both eating and addictive disorders; however, the different forms of dissociation have been relatively understudied in relation to food addiction (FA). The main aim of this study was to investigate the association of certain forms of dissociative experiences (i.e., absorption, detachment and compartmentalization) with FA symptoms in a nonclinical sample.

**Methods** Participants ( $N=755$ ; 543 women; age range: 18–65; mean age:  $28.22 \pm 9.99$  years) were evaluated using self-report measures of FA, dissociation, eating disturbances, and general psychopathology.

**Results** Compartmentalization experiences (defined as pathological over-segregation of higher mental functions) were independently associated with FA symptoms ( $\beta=0.174$ ;  $p=0.013$ ;  $CI=[0.008; 0.064]$ ) even when confounding factors were controlled for.

**Conclusion** This finding suggests that compartmentalization symptoms can have a role in the conceptualization of FA, with such two phenomena possibly sharing common pathogenic processes.

*Level of evidence:* Level V, cross-sectional descriptive study.

**Keywords** Food addiction · Dissociative symptoms · Compartmentalization · Eating disturbances · Psychopathology

## Introduction

Over the last years the construct of Food Addiction (FA) has attracted interest in both clinical and research fields, mainly in relation to certain forms of obesity, to eating disorders (EDs), especially binge-type EDs, and to addictive behaviors [1–3]. To date there is still not an unequivocal definition

of FA, and debates have been occurring on whether FA is an independent nosographic condition or not, and whether it should be conceptualized as a form of ED or as a form of addictive disorder [2, 4, 5]. FA has been conceptualized as a behavioral pattern characterized by uncontrolled and dysregulated consumption of hyper-palatable and highly processed foods (i.e., containing refined carbohydrates and/or added fats such as pizza or French-fries) [3, 6, 7], as well as a behavioral pattern with clinical (e.g., continued overuse despite negative consequences) and neurophysiological (e.g., altered dopamine expression) overlaps with addiction, certain forms of obesity, and binge-type EDs [1, 2, 5].

Under a psychopathological point of view, it has been reported in both clinical (e.g., overweight and obese patients seeking weight-loss treatment) and non-clinical (e.g., students, general population) samples that higher FA symptoms are associated with different physical and psychological conditions such as increased craving and impulsivity, higher body mass index (BMI), and altered eating behavior with recurrent binge eating episodes [e.g., 8–12]. FA has also

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been related with a range of psychiatric disorders, such as depression, anxiety and post-traumatic stress disorder [4, 13].

The etiology of FA and the concomitant features implied in its maintenance are still unclear. For example, although the genetic investigation of FA is still inconclusive [14], it has been recently reported that higher polygenic scores related to dopamine signaling predicted higher FA symptoms in a sample of university students [15]. Also, previous reports [e.g., 16–23] have detected associations between exposure to traumatic experiences, especially when they occur during childhood, and FA severity. In this regard, it is well known [24, 25] that one of the pathogenic processes induced by traumatic experiences is dissociation, which is considered a psychopathological phenomenon frequently detected in both eating and addictive disorders [26–37].

According to the last edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), the term dissociation refers to a “disruption of and/or discontinuity in the normal integration of consciousness, memory, identity, emotion, perception, body representation, motor control, and behavior”; as specified in the same text, “dissociative symptoms can potentially disrupt every area of psychological functioning”, and “dissociative disorders are frequently found in the aftermath of trauma” [38].

Considering the large spectrum of dissociative manifestations, scholars [39, 40] have conceptualized dissociation along a continuum ranging from “normal” (e.g., absorption, “the ability to be totally involved and absorbed in a activity”; [41]), to “pathological” dissociative experiences. It has also been argued that it is unlikely that such heterogeneous dissociative symptoms belong to the same psychopathological category and originate from the same pathogenic process [24, 40, 42–44].

In relation to “pathological” clinically-relevant forms of dissociation, factor analysis investigations, clinical and taxometric studies have suggested the existence of at least two clusters of manifestations [40, 43, 45]. Detachment phenomena are considered as pathological forms of dissociation mainly expressed by symptoms of depersonalization and derealization, reflecting a detachment from the self and reality; compartmentalization phenomena are considered as pathological forms of dissociation which refer to the segregation of integrated functions such as memory or body schema/image, and might be characterized by clinical manifestations including dissociative amnesia or altered emotional and identity control [40].

Assessment and treatment of dissociative manifestations are crucial in clinical practice. Indeed, it is known that the presence of dissociative symptoms can contribute to worsen clinical outcomes and treatment response in several psychiatric disorders, such as EDs [46], borderline personality

disorder [47] and obsessive–compulsive disorder [48]. Of relevance, studies have documented the significant association of dissociative symptoms with both eating and addictive disorders [26–37], raising the possibility that certain dysfunctional behaviors (e.g., diminished control over the consumption of food/ substances) might be in part conceptualized as dissociative-like phenomena aimed at facing negative and stressful mental states [33, 49, 50].

Dissociation has however been rarely studied in relation to FA. Thus, the aim of the current investigation is to explore the association of different forms of dissociative experiences with FA symptoms in a nonclinical sample of adults. We hypothesized that pathological dissociation (i.e., detachment and compartmentalization symptoms) is independently and positively associated with FA symptoms, even after controlling for confounding clinical (i.e., EDs-related symptoms, general psychopathology BMI, substance use) and socio-demographic (i.e., age, sex, educational achievement and occupation) variables related to FA [4, 51, 52].

## Materials and methods

### Participants and procedure

In this study 755 participants were enrolled (543 females, mean age:  $28.22 \pm 9.99$  years; age range: 18–65) between September 2020 and May 2021. They voluntarily and anonymously answered a survey shared online, after having provided an informed consent (without receiving any payment or compensation). The following inclusion criteria were used for the current study: (i) age between 18 and 65 years, (ii) good ability to understand written Italian, (iii) correct response to one attentional quality check item, and (iv) the provision of written consent. The choice of performing the study in a nonclinical sample of adults was driven by data suggesting that such study group can offer an opportunity to understand the development and maintenance of a mental health condition within a continuous spectrum of severity [53].

The amount of participants was selected following an a priori power analysis conducted using G\*Power 3.1 software [54]. It revealed that, given a probability level of 0.05, a sample size of 550 was required to achieve a small effect size ( $f^2 = 0.02$ ) with power = 0.80 in a linear regression analysis with three tested predictor and 14 total number of predictors (details on the predictors are provided below). Since this study is part of a wider research focused on psychopathology and addictions, the sample partially overlaps with that of other studies previously published by our research group [31, 55–57].

## Measures

The following socio-demographic and clinical data were collected for each participant: age, sex, employment, education, substances use, tobacco use, and self-reported weight and height (in order to calculate the BMI). Participants were also asked to answer the following questionnaires: the Dissociative Experience Scale II [DES-II; 58], the modified Yale Food Addiction Scale 2.0 [mYFAS 2.0; 59], the Eating Attitudes Test-26 [EAT-26; 60], the CAGE questionnaire [61], and the Brief Symptom Inventory [BSI; 62]. Socio-demographic and clinical data are listed and described in Table 1.

The DES-II [58, 63] is a 28-items self-report questionnaire measuring several dissociative experiences. Participants rate each item on a 11-points scale ranging from 0 to 100%, indicating the percentage of time the described experience happens in their everyday life. Higher scores suggest more severe dissociative symptoms; a total score of 30 is considered to reflect pathological dissociation [58, 64]. According to Mazzotti et al. [45], DES-II items can assess three different categories of dissociative experiences: absorption, compartmentalization and detachment. In the current study, we used the Italian validated version of the scale [45]. In our study Cronbach's  $\alpha$  was 0.94 for the DES-II total score, 0.91 for the absorption, 0.81 for the compartmentalization, 0.88 for the detachment subscales.

The mYFAS 2.0 [59] is a 13-items scale assessing FA in the previous 12 months according to DSM-5 criteria for Substance-related and Addictive Disorders [38]. While 11 items measure symptoms of FA (e.g., tolerance and craving), 2 items assess FA-related impairment and distress. People are asked to rate each item on an 8-point Likert scale ranging from "never" to "every day". The scale has two scoring options: continuous or categorical (i.e., diagnostic version). Continuous scores can range from 0 to 11, indicating the number of diagnostic criteria met, whereas FA diagnosis is met when at least 2 symptoms and the presence of eating-related clinical impairment or distress are reported. In our study we used an Italian validated version of the scale [65] and Cronbach's alpha was 0.91.

The EAT-26 is a 26-item self-report questionnaire investigating ED-related symptoms and concerns [60]. Subjects are asked to rate each item according to a 6-point Likert scale (from "never/rarely/sometimes" = 0 to "always" = 3). The total score ranges from 0 to 78. A cut-off of  $\geq 20$  is commonly used as the threshold value for clinically significant ED-related pathology [66], with higher scores implying more severe ED-related symptoms. In this study, we used an Italian validated version of the EAT-26 that demonstrated good psychometric properties [67]. In our sample the Cronbach's alpha was 0.93 for the EAT-26 total score.

The CAGE ("Cut-down/Annoyed/Guilty/Open-Eye") is a 4-item questionnaire used to detect problematic alcohol use

**Table 1** Socio-demographic and clinical data of the sample (N = 755)

Age—M $\pm$ SD	28.22 $\pm$ 9.99
Women—N (%)	543 (71.92)
Occupation	
Unemployed—N (%)	73 (9.67)
Students—N (%)	418 (55.36)
Employed—N (%)	264 (34.97)
Educational achievement	
Primary or secondary school—N (%)	16 (2.12)
College—N (%)	405 (53.64)
Graduation—N (%)	334 (44.24)
Substance use in the last 12 months <sup>a</sup> —N (%)	97 (12.85)
Tobacco use in the last 12 months—N (%)	265 (35.10)
BMI—M $\pm$ SD	22.63 $\pm$ 3.93
Underweight	71 (9.40)
Normal weight	533 (70.60)
Overweight	117 (15.50)
Obesity	34 (4.50)
DES II—M $\pm$ SD	13.62 $\pm$ 12.20
Absorption—M $\pm$ SD	19.00 $\pm$ 14.89
Compartmentalization—M $\pm$ SD	5.97 $\pm$ 9.97
Detachment—M $\pm$ SD	7.09 $\pm$ 12.90
DES II > 29—N (%)	71 (9.40)
mYFAS 2.0—M $\pm$ SD	1.09 $\pm$ 2.05
Food addiction—N (%)	75 (9.93)
EAT-26—M $\pm$ SD	10.99 $\pm$ 13.38
EAT-26 $\geq 20$ —N (%)	128 (16.65)
CAGE—M $\pm$ SD	0.44 $\pm$ 0.88
CAGE $\geq 2$ —N (%)	94 (12.45)
BSI	
GSI—M $\pm$ SD	1.08 $\pm$ 0.77
BSI cut-off—N (%)	204 (27.02)

*BMI* Body Mass Index, *DES II* Dissociative Experiences Scale II total score, *mYFAS 2.0* modified Yale Food Addiction Scale 2.0 total score, *EAT-26* Eating Attitude Test-26 total score, *CAGE* cut-down/annoyed/guilty/open-eye questionnaire total score, *BSI* Brief Symptom Inventory, *GSI* Global Severity Index score of the BSI

<sup>a</sup>Number of individuals who reported that the most frequently used psychoactive substance in the previous year was one of the following: cannabis, cocaine, heroin or other opiates, hallucinogens, amphetamines or other psychostimulants, tranquilizers, other substances different from alcohol, nicotine, caffeine, and hyper caloric food

[61]. Total scores range between 0 and 4, with higher scores indicating more severe alcohol use problems. According to previous studies [68], a score of  $\geq 2$  can be used as a cut-off point for detecting problematic alcohol use. In the present study we used the Italian adaptation of the CAGE [69], and the Cronbach's  $\alpha$  was 0.68.

The BSI [62] consists in 53 items assessing nine symptom dimensions: depression, somatization, obsessive-compulsive, interpersonal sensitivity, anxiety, hostility, phobic anxiety, paranoid ideation, and psychoticism. Each item can be

rated on a 5-point Likert scale (0–4). The BSI also provides a global severity index (GSI) measuring the overall psychopathological distress, with higher scores reflecting higher self-report severity of the symptoms. As recommended [62] and according to previous studies [70, 71], we used a cut-off score of T63 on the GSI or in two primary symptom dimensions to detect subjects with clinically-relevant psychopathological distress. We used a previously validated Italian version of the BSI [72]. In our sample, the Cronbach's alpha for the GSI was 0.97.

## Statistical analysis

Statistical analyses were performed using Statistical Package for the Social Sciences 25 (IBM, Armonk, NY, USA). Data were screened for normality according to Kim et al. [73]: specifically, variables were considered normally distributed if the absolute skew value of the distribution was smaller than 2 or the absolute kurtosis value was smaller than 7. Since BMI, detachment and compartmentalization scales were not normally distributed, the correlations were assessed using Spearman's rho coefficients.

In order to assess the independent contribution of dissociative symptoms in explaining FA severity, a multiple linear regression analysis with mYFAS total score as the dependent variable and DES-II subscales (i.e., absorption, detachment and compartmentalization) as independent variables was performed. Potential confounding clinical (i.e., EAT-26 total scores, CAGE total scores, GSI score, BMI, substance and tobacco use) and socio-demographic (i.e., age, sex, educational achievement, occupation and student status) variables associated with FA [4, 51, 52] were controlled for. Assumptions on multiple regression model were tested according to Williams et al. [74]. Cook's distances were also computed. Collinearity was assessed through the statistical factor of tolerance and Variance Inflation Factor (VIF). The associations between variables were reported as standardized beta coefficients ( $\beta$ ) and their  $p$ -values.

## Results

According to the cutoff scores of the previously mentioned scales, in our sample 71 subjects (9.40%) showed threshold values compatible with pathological dissociation; 75 participants (9.93%) showed threshold values compatible with FA; 128 participants (16.65%) showed threshold values compatible with ED-related pathology; 94 subjects (12.45%) showed threshold values compatible with problematic alcohol use; 204 (27.02%) participants showed threshold values compatible with clinically relevant psychopathological distress. Further, according to the standard BMI cut scores [75], there were 71 (9.40%) underweight, 533 (70.60%) normal

weight, 117 (15.50%) overweight, and 34 (4.50%) obese participants.

FA severity was correlated with all DES-II subscales (absorption:  $\rho = 0.301$   $p < 0.001$ ; compartmentalization:  $\rho = 0.273$   $p < 0.001$ ; detachment:  $\rho = 0.298$   $p < 0.001$ ). The mYFAS 2.0 total score was also positively correlated with self-reported BMI ( $\rho = 0.173$   $p < 0.001$ ), EAT-26 total score ( $\rho = 0.471$   $p < 0.001$ ), CAGE total score ( $\rho = 0.185$   $p < 0.001$ ) and GSI ( $\rho = 0.418$   $p < 0.001$ ). Detailed correlations are reported in Supplementary Table S1.

Assumptions on multiple regression were respected with the exception of homoscedasticity. Thus, according to Williams et al. [74], a generalized linear regression model with robust standard errors was performed. The results of the linear regression analysis are reported in Table 2. The model explained 31% of the variability of the mYFAS 2.0 ( $F_{1,753} = 197.14$ ;  $p < 0.001$ ). Among the different DES-II sub-scales, compartmentalization ( $\beta = 0.174$ ;  $p = 0.013$ ; CI = [0.008; 0.064]; Fig. 1) was the only DES-II sub-scale independently associated with FA. Education, BMI, EAT-26 and GSI scores were also independently associated with FA scores. No other significant associations were found. The statistical factor of tolerance and VIF showed that there were no interfering interactions between the variables (i.e., tolerance values  $> 0.10$  and VIF  $< 5$ ). Cook's distances were also satisfactory (i.e., max value = 0.09).

## Discussion

The main aim of the current study was to evaluate the association of different forms of dissociative experiences with FA symptoms in a non-clinical sample of adults, controlling for confounding variables. Our results showed that absorption, compartmentalization and detachment severity were positively associated with FA symptoms. However only compartmentalization remained independently associated with mYFAS 2.0 total scores when confounding variables were taken into consideration, suggesting that this specific dissociative form may have an important role in the conceptualization of FA.

Our results seem in line with previous studies which reported significant associations of dissociative symptoms with both eating and addictive disorders [28, 31, 76, 77], suggesting that certain dysfunctional behaviors (e.g., diminished control over food consumption or substance use) might at least partially be conceptualized as dissociative-like phenomena, which can be aimed at alleviating negative and stressful mental states [26, 33, 49].

To the best of our knowledge, this is the first study investigating the association of specific forms of dissociative experiences (i.e., absorption, detachment and compartmentalization) with FA. According to Holmes et al. [40],

**Table 2** Linear regression analysis in all sample (N = 755)

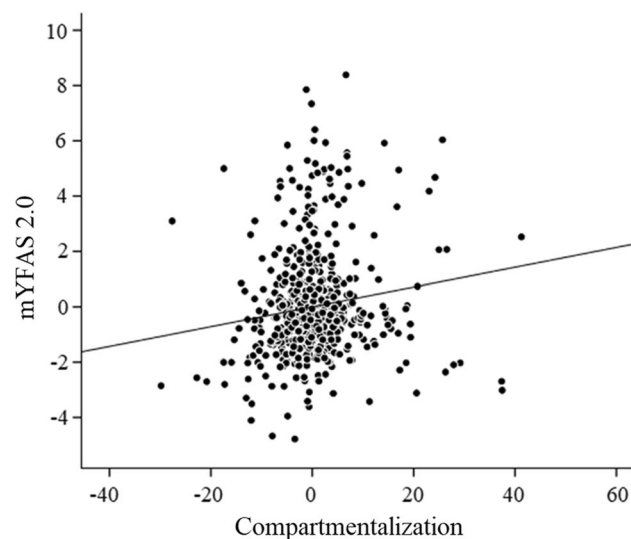
Dependent variable	Adjusted R <sup>2</sup>	F <sub>1,753</sub>	Independent variables	$\beta$	p	[95% CI]
mYFAS 2.0	0.31	197.139***	Age	-0.052	0.219	[-0.027;0.006]
			Sex	0.012	0.726	[-0.242;0.347]
			Educational achievement	<b>0.071</b>	<b>0.040</b>	<b>[0.012;.529]</b>
			Employed	-0.057	0.375	[0.786;0.296]
			Student	-0.124	0.064	[-0.1.054;0.030]
			BMI	<b>0.214</b>	<b>&lt;0.001</b>	<b>[0.056;0.167]</b>
			Illicit drugs use	0.013	0.700	[-0.329;0.489]
			Tobacco use	-0.034	0.271	[-0.405;0.114]
			CAGE	0.066	0.105	[-0.032;0.338]
			EAT-26	<b>0.266</b>	<b>&lt;0.001</b>	<b>[0.025;0.056]</b>
			BSI-GSI	<b>0.287</b>	<b>&lt;0.001</b>	<b>[0.508;1.017]</b>
			Absorption	-0.065	0.237	[-0.024;0.006]
			Compartmentalization	<b>0.174</b>	<b>0.013</b>	<b>[0.008;0.064]</b>
			Detachment	0.024	0.709	[-0.016;0.024]

In bold significant variables associated with mYFAS 2.0 total score

*BMI* Body Mass Index, *mYFAS 2.0* modified Yale Food Addiction Scale 2.0 total score, *EAT-26* Eating Attitude Test-26 total score, *CAGE* Cut-down/Annoyed/Guilty/Open-eye questionnaire total score, *BSI\_GSI* Global Severity Index of the Brief Symptom Inventory score

Coding system: sex: 1 = man, 2 = woman; employed: 0 = no, 1 = yes, student: 0 = no, 1 = yes; educational achievement: 1 = primary or secondary school, 2 = college 3 = graduation; illicit drugs use: 0 = no, 1 = yes; tobacco use: 0 = no, 1 = yes

\*\*\*  $p < 0.001$



**Fig. 1** Scatterplot of the association (controlling for confounding variables) between mYFAS 2.0 total score and compartmentalization ( $\beta = 0.174$ ;  $p = 0.013$ )

compartmentalization is a “deficit in the ability to deliberately control processes or actions that would normally be amenable to such control”. More specifically, compartmentalization is considered as a disturbance of the normal integration of higher mental functions including consciousness, memory and self-identity, as well as executive functions and affective/behavioural regulation [42, 43]. The observed association of compartmentalization severity with FA symptoms

might reflect a common pathogenic process, possibly linked to previous traumatic experiences, characterized by poor top-down control and poor self-control, which have been reported in individuals with both high level of FA [78, 79] and dissociative symptoms [80]. Consistently, it is known that both FA symptoms [e.g., 16–22] and compartmentalization symptoms [24, 25, 44] are strongly related to a history of traumatic experiences. More specifically, while detachment symptoms are common even in absence of previous traumatic events [43, 44], compartmentalization symptoms are strongly linked to developmental traumas that typically generate difficulties in the regulation of impulses, emotions, and behavior [25, 44].

On the other hand, the symptoms of compartmentalization concern the sphere of self-identity and body image. Indeed, several authors [e.g., 40, 81, 82] have suggested that compartmentalization experiences also comprise somatoform manifestations of dissociation (i.e., symptoms that phenomenologically involve the body) and that a lack of integration of one’s sense of self might be related to body image distortion [83]. Accordingly, in a non-clinical sample of students, Fuller-Tyszkiewicz and Mussap [84] reported the association between somatic symptoms of dissociation and both body image dissatisfaction and body size distortion. These results were also replicated in patients with EDs [e.g., 37]. Interestingly, although diagnostic criteria for FA do not include body image related symptoms, the association between FA and body image disturbance is well documented



[85–88]. Thus, compartmentalization phenomena might also reflect, at least in part, one of the underlying mechanisms this relationship (e.g., the presence of a pathogenic process interfering with integration of different aspects of the self that involves body representation).

Beyond dissociative symptoms, similarly to what observed in previous studies, our results also showed that FA symptoms were independently and positively associated with psychopathology severity and ED-related pathology [13, 51, 89]. Moreover, according to our regression model, FA symptoms were also positively associated with educational level, and such finding is not consistent with previous evidence. For example, Ayaz and colleagues [90] reported a negative association between educational levels and FA symptoms in a sample of Turkish healthy subjects. Such discrepancy may be explained by differences in study designs and methods (e.g., the use of the YFAS vs the mYFAS 2.0) and also by potential cross-cultural differences that have been observed in relation to FA and other addictive eating behaviors [51].

### Strengths and limits

The results of the present study should be considered in light of some limitations. First, participants were recruited from the general population (i.e., nonclinical sample) using self-report measures, and for this reason an objective assessment of traumatic experiences as well as of mental health status was not performed. Therefore, future studies should investigate the relationship between FA symptoms and dissociative experiences also in clinical setting (e.g., overweight and obese patients seeking weight-loss treatment) using heterogeneous methodology (e.g., questionnaires and structured clinical interviews). Furthermore, we used a cross-sectional design. Thus a causal interpretation of the observed significant associations is not possible (longitudinal approaches should be encouraged). Third, a potential selection bias might be present as certain groups of individuals are more represented in the included sample (e.g., students compared to non-students, females compared to males). Similarly, the survey was disseminated online, thus it might have been more accessible to individuals spending more time on the Internet. Despite this, according to the described cut scores, in the present sample, 71 participants (9.40%) showed threshold values compatible with pathological dissociation and 75 individuals (9.93%) showed threshold values compatible with FA. Such values are not far from the prevalence of both conditions detected by other studies focused on non-clinical samples (i.e., FA = 14% [52]; pathological dissociation = 10.9% [45]), confirming their high rate also in the general population.

### What is already known on this subject?

The association between dissociative symptoms with both eating and addictive disorders is well documented. Similarly, it is known that FA is strongly related with psychopathology. Despite this, dissociation has been rarely studied in relation to FA.

### What this study adds?

To the best of our knowledge this is the first study to investigate the association between dissociation severity and FA symptoms.

Given the strong relationship of dissociative manifestations with FA symptoms, our results highlight the need of paying specific attention on these phenomena from preventive, clinical, and research perspectives. Indeed, it has been established that the presence dissociative symptoms in patients with psychiatric disorders is associated with negative treatment outcomes [24], suggesting the relevance to incorporate specific strategies with more conventional therapies. It is also possible that the presence of certain clusters of dissociative symptoms may influence the treatment response to different forms of interventions as well as the disease course even among individuals with similar FA-related disorders (e.g. certain forms of obesity, binge-type EDs, addiction), consistently with evidence highlighting that specific psychopathological dimensions can modulate clinical outcomes within subjects with the same categorical diagnosis [91, 92]. Overall, our results suggest that compartmentalization symptoms can have an important role in the conceptualization of FA and underline the relevance of further studies on the topic.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s40519-023-01555-2>.

**Author contributions** Study concept and design: FSB, CI, OC, BF, IT, LT, MP, MB; (ii) Acquisition of subjects and/or data: GAC, EDR, CI, CM, EP, CM, FSB; (iii) Analysis and interpretation of the data: GAC, EDR, EP, LT, BF, CI, FSB; (iv) writing—original draft: GAC, EDR, CI, FSB; (v) writing—review and editing: EP, LT, OC, BF, MP, IT, CM, MB. All authors read and approved the final manuscript.

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**Data availability** Aggregated data may be available from the corresponding author upon reasonable request.

### Declarations

**Conflict of interest** The authors have no relevant financial or non-financial interests to disclose.

**Ethical approval** The study was approved by the Institutional Review Board of the Department of Human Neurosciences of Sapienza University of Rome (prot 3/2019, 22 October 2019).

**Informed consent** All subjects gave their written informed consent to take part to the study and to have the results of the study published in scientific articles.

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