ORIGINAL ARTICLE

Do Executive Functioning Deficits Underpin Binge Eating Disorder? A Comparison of Overweight Women with and without Binge Eating Pathology

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ABSTRACT

Objective: Deficits in executive function (EF)—including inhibitory control, cognitive flexibility, decision-making, and working memory—may be risk or maintenance factors for binge eating disorder (BED). However, there is mixed evidence regarding EF deficits in individuals with BED. Significant methodological weaknesses (e.g., use of a single EF measure, omission of relevant covariates) in the current literature represent one reason for lack of consensus.

Method: This study compared EF in a sample of overweight women with ($n = 31$) and without ($n = 43$) full or subthreshold BED, with the aim of conducting a multifaceted investigation of the neurocognitive profile of BED. A neuropsychological battery of EF was administered to all participants.

Results: After controlling for IQ and age, individuals with binge eating displayed significantly poorer performance on tasks of problem-solving and inhibitory control, and displayed higher prioritization of immediate versus delayed rewards, but the two groups did not appear to differ on set-shifting, working memory, and risk taking. Differences in inhibitory control were no longer statistically significant when depressive symptomology was added as a covariate and correction for multiple comparisons was applied. Exploratory analyses indicated that full and sub-threshold BED groups did not differ in EF.

Discussion: Results partially support the hypothesis of relative EF deficits in individuals with BED, suggesting that binge eating may be maintained by cognitive factors distinct from those of obesity. Future research should aim to replicate with a larger sample, control for a wider range of psychiatric comorbidities, and examine whether EF deficits predict treatment outcome. © 2014 Wiley Periodicals, Inc.

Keywords: binge eating disorder; executive function; neuropsychology; obesity; delayed discounting; inhibitory control; problem-solving; cognitive function; loss-of-control eating

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Introduction

Binge eating (BE) is defined as eating an objectively large amount of food within a discrete time period, accompanied by a sense of loss of control (LOC) over eating. BE and binge eating disorder (BED) cause significant psychological distress, are associated with poor long-term outcomes, and are highly comorbid with obesity[1]. Compared with their obese counterparts, individuals with BED have higher rates of psychiatric comorbidity, poorer quality of life, and suffer increased social and occupational impairments related to excess weight[1]. Growing evidence suggests that cognitive processes, such as executive function (EF), underlie eating behavior; however, the cognitive processes underlying BE and BED are currently poorly understood[2]. Identification of neurocognitive weaknesses in this population has the potential to pinpoint risk factors, suggest markers for severity and prognosis, and provide direction for developing more effective interventions.

EF and Binge Eating

EF encompasses an overlapping group of higher-level cognitive control processes that enable an individual to perform goal-directed behavior[3]. Preliminary evidence suggests that a spectrum of eating

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and weight disorders is associated with relative deficits in EF[4,5]; however, at this time, research examining EF deficits in BED is limited. While BE and obesity are often co-morbid, the majority of obese individuals do not have BED[6], suggesting an independent course of development and/or maintenance for BE.

Few studies have investigated EF in a BED sample. These studies have provided preliminary evidence for relative EF weaknesses in adults with BED (e.g., relative deficits in decision-making and inhibitory control); however, results have been mixed across five areas of EF. First, cognitive flexibility (i.e., an individual's ability to shift cognitive set and generate alternative strategies that are adaptive long term) has been associated with BED, but less so when relevant covariates are controlled[3,7–10]. Second, inhibitory control problems (i.e., poor ability to inhibit prepotent responses) may increase responsivity to potential internal and external cues[11]; however, only three[10,12,13] of six studies[8,10,12–14] have detected poorer inhibitory control in BED samples compared with controls. Third, poor decision-making (i.e., taking unnecessary risks, and prioritizing short-term reward over long-term goals) may underpin the tendency to binge eating for short-term comfort, without forethought to the long-term consequences (e.g., weight gain, feelings of guilt). Two studies have detected deficits in delayed discounting and decision-making[7,15] in BED samples, but several studies failed to do so[10,16,17]. Fourth, deficits in problem solving could lead to an inability to optimally generate and select a sequence of specific strategies to achieve a specific goal (e.g., planning meals so not to experience extreme hunger). Two studies have reported problem-solving deficits in those with BE[8,10]. Lastly, poor working memory (i.e., the ability to keep goal-relevant information in mind in the face of distractors) could predispose an individual to let self-regulative goals be overcome by cues[18]. One of two studies has reported relative working memory deficits in a BED sample[8].

This Study

This study aimed to more clearly elucidate cognitive deficits that are associated with BE by using a comprehensive battery of EF tasks (rather than a single "umbrella" measure) and by controlling for relevant covariates, such as age, IQ, and depressive symptoms, which many studies have neglected to do. We hypothesized that overweight and obese individuals with BE would perform more poorly on EF tasks compared with overweight and obese individuals without BE in the areas of cognitive flexibility, inhibitory control, planning, decision-making, and working memory. We additionally hypothesized that EF performance would be negatively associated with BE frequency. A body of literature suggests that the presence of LOC, rather than the size (i.e., "objectively" vs. "subjectively" large) of binge episodes, is the construct most strongly associated with psychological impairments and poor outcome in BED[19]; individuals exclusively with objectively large binge episodes do not appear to meaningfully differ clinically from those who endorse primarily subjectively large binge episodes. Thus, we recruited a sample that met frequency criteria for BED (one binge episode per week), but binge episodes could have been subjectively and/or objectively large. As an exploratory analysis, we examined whether full and subthreshold BED groups differed in EF.

Method

Participants

The current study included overweight and obese (BMI = 26–50 kg/m^2) adults (ages 18–70) who endorsed BE symptomology in the preceding 3 months and a control group of overweight and obese adults without any past or present BE. Participants in the overweight control group (OWC) were free of any LOC eating episodes in the past 3 months, and had no current or past history of BE or an eating disorder. All participants could not have reported recently (i.e., within the last 3 months) starting, stopping, or changing the dose of prescription medications known to affect weight or appetite. They also could not have any medical conditions responsible for their obesity. Participants in the binge eating group (BE) were required to have endorsed an average of at least one subjective (i.e., the quantity of food consumed during the binge did not qualify as "objectively large") or objective binge episode per week over the past 3 months (i.e., at least 12 total binge episodes over the past 3 months), and must not have met criteria for bulimia nervosa. All participants were seeking behavioral treatment for either weight loss or BE, were fluent in English, had the capacity to give consent, reported 3-month stability in psychiatric medication, and negative history of neurological conditions or traumatic brain injury.

Procedures

Participants received $50 for completion of the assessment. Recruitment for the trials took place through sources in the community (e.g., radio ads) and Internet. The neuropsychological battery and Eating Disorders Examination (EDE) were administered by a trained assessor. Participants completed self-report questionnaires

through a secure survey website. A licensed clinical psychologist supervised all neuropsychological assessments, and the order of administration of computer tasks was counterbalanced.

Measures

BE was assessed via the EDE Version 16D[20], which is a standardized semistructured interview, measuring the severity and frequency of the psychopathology and key behaviors of eating disorders. Depressive symptoms were measured by the Beck Depression Inventory-II[21], a self-report measure of symptomatology in the previous two weeks. The BDI-II has excellent psychometric properties[22], and internal consistency in our sample was excellent ($\alpha = 0.92$).

We administered the Wechsler Test of Adult Reading[23] as an estimate of IQ given its strong association ($r = 0.70 - 0.80$) with full scale IQ[23]. Cognitive flexibility was measured via the percentage of perseverative errors made on the Penn Conditional Exclusion Task (PCET)[24], a computerized set-shifting task. For each trial, the participant selected one of four shapes on the screen that did not belong with the other three based on one of three separate criteria, and received immediate feedback on their responses.

Inhibitory control was measured using total number of commission errors made, and time to complete the Inhibition and Inhibition/Switch conditions, on the Delis-Kaplan Executive Functioning System (D-KEFS) Color-Word Interference Task[25], a modified Stroop task with four trials: (1) Participants were presented with blocks of color and were told to name the colors, (2) Participants were told to read words, (3) Color names written in dissonant color ink, and participants were told to name the ink color, and (4) Same instructions, except if a word is in a box, participants were to read the word.

Delayed discounting was assessed with the Delayed Discounting Task (DDT)[26], a commonly used computerized monetary discounting task. Participants were asked to choose between a hypothetical variable monetary amount that could be received immediately and a larger amount to be received after varying delays. Area-under-the-curve[27] was calculated from indifference points, the points at which the subjective value of the delayed reward was equal to the amount of the immediate reward.

Risk taking was assessed using adjusted average number of balloon pumps on the Balloon Analogue Risk Task (BART). During the BART, participants completed 10 trials in which they received hypothetical money for each pump of a simulated balloon. The balloon may pop at any point (at which the money is lost), or the participant may elect to stop clicking and to save the money.

Problem-solving was assessed with Achievement Score (derived from number of moves to complete each trial) on the D-KEFS Tower Task[25], which requires participants to build a series of nine towers on a three-peg base using colored disks. For each item, participants were given the base with disks placed in a prearranged manner and are shown a picture of the tower's ending position. They were instructed to build this tower using as few moves as possible.

Working memory was assessed using an 'efficiency score' (which incorporates accuracy and reaction times) of the Penn Letter N-Back Task[28], a computerized working memory task. In the 0-back condition of the task, participants responded to a single target. During the 1-back condition, participants responded if the consonant presented on the screen was identical to one preceding it. In the 2-back condition, participants responded if the letter was identical to one presented two trials back.

The measures above were chosen based on their excellent psychometric properties[23,24,29,30].

Data Analysis

Statistical Package for the Social Sciences vs. 20.0[31] was used to analyze data. Due to computer malfunction and resulting data loss, several participants were missing data on the DDT ($n = 7$) and N-back/PCET ($n = 6$) tasks. All dependent variables were examined for skew. Where detected (i.e., DDT and all Color-Word Interference variables), variables were log transformed, and analyses were conducted using both non-transformed and transformed variables. Transforming variables did not substantively alter results; thus, analyses using non-transformed variables are reported for simplicity. Because depressive symptoms could possibly explain differences in EF between groups, analyses were run with and without depressive symptoms (as measured by BDI-II score) as a covariate. Age was included as a covariate to control for pre-existing group differences and because of its known association with EF[32]. IQ was also included as a covariate, given its association with performance on several tasks in our sample. After controlling for depressive symptoms, we applied False Discovery Rate (FDR)[33] to correct for multiple comparisons.

Results

Participant Characteristics

Sample demographics and clinical characteristics are presented in **Table 1**. No BMI or IQ differences were observed between groups. Consistent with previous research, the BE group ($n = 31$) was significantly more depressed and presented with higher levels of eating disorder psychopathology than the OWC group ($n = 43$) group. In addition, the BE group was younger than the OWC group. In the OWC group, 14.0% of participants ($n = 6$) were taking a psychiatric medication [either a selective serotonin reuptake inhibitor (SSRI), selective

TABLE 1. Sample descriptive and clinical characteristics by group

	BE ($n = 31$); *M* (SD)	OWC ($n = 43$); *M* (SD)	*T*	Cohen's *d*
Age (yrs)	45.06 (14.86)	51.09 (8.26)	2.04[a]	0.50
Body Mass Index (kg/m^2)	36.84 (7.97)	37.85 (6.27)	0.02	0.14
IQ	111.74 (12.31)	112.63 (10.52)	0.33	0.08
BDI-II	17.94 (10.17)	7.58 (6.78)	5.26[b]	1.20
OBEs in past month	10.97 (9.32)	0.00 (0)	7.74[b]	1.60
SBEs in past month	5.74 (11.39)	0.00 (0)	2.80[c]	0.71
EDE-Q Restraint	1.76 (1.34)	1.45 (1.22)	0.90	0.24
EDE-Q Eating Concern	2.52 (1.35)	1.04 (.97)	4.65[b]	1.26
EDE-Q Shape Concern	4.06 (1.48)	3.54 (1.20)	1.42	0.39
EDE-Q Weight Concern	3.80 (1.17)	3.04 (.82)	2.79[a]	0.75
EDE-Q Global Score	3.07 (1.07)	2.27 (.75)	3.10[c]	0.87

Notes: BE: Binge eating group; OWC: overweight control group; BDI-II: beck depression inventory II; EDE-Q: eating disorders examination questionnaire; OBEs: objective binge episodes; SBEs: subjective binge episodes.
[a] $p < 0.05$.
[b] $p < 0.001$.
[c] $p < 0.01$.

serotonin norepinephrine reuptake inhibitor (SSNRI), or a norepinephrine-dopamine reuptake inhibitor]. In the BED group, 38.7% ($n = 12$) were taking at least one psychiatric medication. Six were taking a combination of an antidepressant (an SSRI, SSNRI, norepinephrine-dopamine reuptake inhibitor, or tricyclic antidepressant) and an anxiolytic (benzodiazepine) or mood stabilizer (lamotrigine), and three were taking either an anxiolytic (benzodiazepine) or mood stabilizer (lamotrigine) in the absence of an antidepressant.

EF Differences Between BE and OWC Groups

For between-group uncorrected means and standard deviations on each EF task, see **Table 2**. Controlling only for age and IQ, ANCOVA results revealed that the BE group, when compared to the OWC group, displayed significantly steeper monetary discounting on the DDT, and showed inferior performance on the Tower Task. The two groups did not appear to differ on number of errors made on the Color-Word Interference Task; however, the BE group was significantly slower to complete the Inhibition condition, and the Inhibition-Switch condition. No differences were detected between groups on the variables in percent perseverative errors committed on the PCET, N-back efficiency score, or average adjusted pump count on the BART. Results after adding depressive symptoms as a covariate were largely equivalent (see **Table2**), with the exception of Inhibition time significance level lowering to trend level. Lastly, FDR[33] was applied to the values obtained after controlling for depressive symptoms, to correct for multiple comparisons. After FDR correction, the significance level of Inhibition-Switch Time was lowered to trend level ($p = 0.096$) and Inhibition Time was not statistically significant ($p = 0.13$), but Tower Achievement Score and DDT remained statistically significant ($ps < 0.05$).

EF as a Predictor of Frequency of Binge Episodes

Simultaneous multiple regression analyses with three predictors (age, IQ, EF variable) were conducted to examine the independent effect of EF variables on total number of OBEs and SBEs among participants in the BE group. Over and above the effects of age and IQ, virtually no relation was evident between frequency of binge episodes and any of the EF variables including the DDT ($F(1, 21) = 0.07$, $p = 0.79$, $\eta^2_p = 0.04$), Tower task performance ($F(1,27) = 0.06$, $p = 0.81$, $\eta^2_p < 0.01$), Color-Word Task errors ($F(1,27) = 0.05$, $p = 0.82$, $\eta^2_p < 0.01$), Color-Word Inhibition time ($F(1, 27) = 0.01$, $p = 0.91$, $\eta^2_p < 0.01$), Color-Word Inhibition-Switch time ($F(1, 27) = 1.00$, $p = 0.33$, $\eta^2_p = 0.04$), adjusted average pumps on the BART ($F(1, 23) = 0.26$, $p = 0.62$, $\eta^2_p = 0.01$), N-back efficiency score ($F(1,23) = 0.04$, $p = 0.85$, $\eta^2_p < 0.01$), or percent perseverative errors on the PCET ($F(1, 23) = 0.52$, $p = 0.48$, $\eta^2_p = 0.02$).

Comparing EF Among Full and Subthreshold Groups

Within the BED sample, 22 participants met full criteria for BED (full-BED) while nine were categorized into the subthreshold group (sub-BED). Due to small cell size, these analyses were exploratory in nature, and examination of effect sizes was prioritized. The BMI and IQ of the three groups appeared equivalent, but the full-BED group ($M_{age} = 42.05$, SD = 15.45) was younger than both the sub-BED ($M_{age} = 52.44$, SD = 10.72) and OWC groups ($M_{age} = 51.09$, SD = 8.26).

With regards to EF, the overall ANCOVA detected medium-sized differences among the three groups on the DDT, time to complete the Inhibition and Inhibition-Switch Conditions of the Color-Word Task, and Tower Task Achievement Score ($\eta^2_p = 0.08 - 0.12$), but differences were not apparent on other EF variables (see **Table 3**). Consistent with hypotheses, post-hoc analyses revealed that the OWC group performed the best of the three groups on all tasks. However, full-BED and sub-BED groups did not appear to differ on EF, as determined by negligible to very small effect sizes ($\eta^2_p = 0.00 - 0.03$)

TABLE 2. Group differences in EF, with and without depressive symptoms as a covariate

	Group		Covariates: Age, IQ		Covariates: Age, IQ, depressive symptoms	
	BE ($n = 31$) *M* (SD)	OWC ($n = 43$) *M* (SD)	*F* [df]	η^2_p	*F* [df]	η^2_p
Delayed Discounting Task						
Level of discounting[a]	0.62 (0.16)	0.72 (0.18)	6.00[b] [1,63]	0.09	6.21[c,d][1,62]	0.10
Tower Task						
Achievement Score	14.90 (3.66)	17.51 (3.71)	8.06[c] [1,70]	0.10	8.23[c,d] [1,69]	0.11
Color-Word Interference Task						
Total Errors	3.71 (4.03)	3.35 (3.46)	.59 [1,70]	0.01	0.78[e] [1,69]	0.01
Inhibition Time	56.57 (15.89)	53.11 (10.92)	4.38[b] [1,70]	0.06	3.45[e,f] [1,69]	0.05
Inhibition-Switch Time	65.92 (20.66)	60.59 (17.05)	5.94[b] [1,70]	0.08	4.02[b,g] [1,69]	0.05
Penn Conditional Exclusion Task						
Percent Perseverative Errors	0.23 (0.10)	0.22 (0.08)	0.14 [1,64]	0.00	1.02[e] [1,63]	0.01
Penn Letter N-back task						
Efficiency Score	4.38 (0.50)	4.46 (0.68)	0.88 [1,64]	0.01	0.13[e] [1,63]	0.00
Balloon Analogue Risk Task						
Adjusted Average Pumps	20.54 (15.05)	23.65 (15.92)	1.24 [1,70]	0.02	1.26[e] [1,69]	0.02

Notes: BE: binge eating group; OWC: overweight control group.
[a]Smaller numbers indicate steeper discounting.
[b]$p < 0.05$.
[c]$p < 0.01$.
[d]$p < 0.05$ after false discovery rate (FDR) correction.
[e]$p > 0.10$ after FDR correction.
[f]$p = 0.05 - 0.10$.
[g]$p = 0.05 - 0.10$ after FDR correction.

Discussion

Overall, this study partially supported the hypotheses that overweight and obese individuals with BE display weaknesses in problem-solving, delayed discounting, and inhibitory control compared to overweight controls. All results but one index of inhibitory control remained statistically significant when controlling for depressive symptoms; however, differences in all indices of inhibitory control were no longer statistically significant after FDR correction. We did not obtain support for hypothesized differences between groups in set-shifting, working memory, or risk-taking. Lastly, we also did not obtain support for hypothesized inverse associations between binge eating frequency and EF.

The relative EF weaknesses observed in the BE group (problem-solving, delayed discounting and inhibitory control) may be indicative of potential risk and/or maintenance factors for BE. Poor problem solving ability, for example, may contribute to the maintenance of irregular eating patterns (e.g., going long periods of time without eating) that

TABLE 3. Differences in EF among overweight control, BED, and subthreshold BED groups, controlling for age and IQ

	Group			ANCOVA		Post hoc Comparisons		
	Full-BED ($n = 22$)	Sub-BED ($n = 9$)	OWC ($n = 43$)	*F*	η^2_p	BED vs. OWC p, η^2_p	Sub vs. OWC p, η^2_p	Sub vs. BED p, η^2_p
DDT								
Level of discounting[a]	0.63 (0.17)	0.62 (0.14)	0.73 (0.18)	2.81[b]	0.09	0.05, 0.07	0.07, 0.08	0.56, 0.02
Tower Task								
Achievement Score	15.41 (2.92)	13.67 (5.03)	17.51 (3.71)	4.86[c]	0.12	0.25, 0.06	0.01, 0.12	0.34, 0.03
Color-Word Interference Task								
Total Errors	3.36 (4.38)	4.56 (3.09)	3.34 (3.46)	0.33	0.01	–	–	–
Inhibition Time	53.40 (11.62)	64.32 (22.30)	53.11 (10.92)	3.05[c]	0.08	0.37, 0.02	0.03, 0.09	0.40, 0.03
Inhibition-Switch Time	62.50 (19.69)	74.28 (21.73)	60.60 (17.05)	3.11[c]	0.08	0.10, 0.05	0.04, 0.08	0.67, 0.01
Penn Conditional Exclusion Task								
Percent perseverative errors	0.22 (0.08)	0.25 (0.12)	0.22 (0.08)	0.43	0.01	–	–	–
Penn Letter N-Back								
Efficiency Score	4.29 (0.54)	4.59 (0.33)	4.46 (0.68)	0.94	0.03	–	–	–
Balloon Analogue Risk Task								
Average adjusted pump count	11.92 (11.92)	22.59 (20.68)	23.65 (15.92)	1.11	0.03	–	–	–

Full BED: full threshold BED, Sub-BED: subthreshold BED, OWC: overweight control group.
[a]Smaller numbers indicate steeper discounting.
[b]$p = 0.05 - 0.10$.
[c]$p < 0.05$.

increase susceptibility to BE. For instance, maintaining a regular pattern of eating (an important preventative factor for BE) requires several types of problem solving skills, including identification of the problem (e.g., that BE tends to occur after long periods of time without eating), generation of a planned solution (e.g., eating every 3–4 h) and implementation of the solution (e.g., bringing snacks to work). Thus, difficulties with problem solving may contribute to the maintenance of a dietary restraint and BE cycle.

With regards to the finding of steeper monetary discounting in the BE group, BE may serve the purpose of escaping the experience of negative emotions, or temporarily provide comfort (i.e., short-term gratification). However, this short-term comfort comes at the expense of long-term consequences (e.g., feelings of guilt, fullness, and weight gain), akin to steeper discounting, which reflects a prioritization of immediate versus delayed reward.

Lastly, consistent with several previous studies[7,10,12], the slower completion of Inhibition and Inhibition-Switch Conditions suggests that binge eating may be characterized by a reduced ability to efficiently recruit inhibition processes. However, group differences in inhibitory control were attenuated (i.e., to trend level significance) after controlling for depression, and neither index was statistically significant after FDR correction, which indicates that differences in inhibitory control should be interpreted cautiously, and further studies should aim to replicate findings with a larger sample. The lack of detected differences between BE and OWC groups in set-shifting, working memory, or risk-taking could indicate that these facets of EF may not be specific to the development or maintenance of BE.

The observed lack of association between EF and BE frequency suggests that EF may not be as relevant as other factors (e.g., level of dietary restriction, emotion regulation skills) in determining the frequency of binge episodes. The lack of detected differences between the BED and sub-BED groups may indicate that any EF deficits observed in BED groups may pertain more to the presence of LOC rather than to size or frequency of binge episodes. These findings support a greater body of evidence suggesting that the presence of LOC may be the most central feature of BE with regards to clinical impairment[19].

BED is related to and highly comorbid with, disorders characterized by impulse control difficulties, such as substance abuse disorders, Cluster B personality disorders, and compulsive gambling[34]. From this perspective, impulsivity may be a cross-cutting dimension that is related to the observed relative EF weaknesses in inhibitory control, problem-solving, and delayed discounting in our BED sample. Impulsivity is subserved by dysfunctions in frontostriatal neural systems[35] that may overlap between BED and these disorders, perhaps suggesting a common neurobiological basis. We were unable to assess for such overlapping disorders, which should be considered a limitation; future research should aim to be able to rule out comorbidities as the explanation for group differences. Relatedly, a body of literature has examined similarities between obesity and BE with addiction. Relative weaknesses in EF processes observed in the present study are consistent with neurobiological addiction models that, among several abnormalities, implicate diminished EF[36]; however, despite these observed similarities, there is ongoing debate on the classification of BE and obesity as addictive-type disorders[37,38]. Consistent with current movements in the field, future research should aim to use multimodal measurement (e.g., neuroimaging, behavioral paradigms) to elucidate overlap and differences between addictive disorders, BE, and obesity.

A number of important limitations are relevant when considering study findings. For example, our data are cross-sectional (which precludes conclusions about temporality and causality), we did not assess and control for the presence of psychiatric comorbidities (only level of depressive symptoms were assessed), our sample size was small (which may contribute to attenuation of inhibitory control *p*-values to below statistical significance once FDR was applied) and only included treatment-seeking overweight and obese females, and we did not include healthy-weight control and healthy-weight BE groups. Inclusion of normal weight groups would allow for a thorough examination of the EF factors specifically associated with weight and/or BE. In addition, BE and OW groups were not matched on age; this limitation was mitigated by the overlap in recruitment methods and by statistically controlling for age.

Overall, this study demonstrated that several aspects of EF differ between overweight individuals with and without BE. Future research would benefit from examining whether observed relative deficits in EF are predictive of psychological treatment outcome to potentially provide direction for treatment development.

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