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## Vegetarianism and weight status: What are the differences in eating styles, impulsivity, and emotional competences? A preliminary study

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### ABSTRACT

Recent studies suggest that vegetarian diets may be recommended to promote weight loss in individuals living with obesity. However, limited studies have examined psychological factors (e.g., eating styles, impulsivity) among individuals who have adopted this type of diet, even though these factors are known to play a role in being overweight. The primary objective of the present study was to compare these characteristics in participants living with obesity or those with normal-weight across diet types. Participants were recruited from two hospital nutrition departments and the general population. They completed a diagnostic interview assessing the presence of an eating disorder, followed by self-administered questionnaires measuring dysfunctional eating styles (DEBQ), impulsivity (UPPS), and emotional competence (PEC). Vegetarian participants living with obesity engaged in more dysfunctional eating styles than did normal-weight omnivores and experienced more emotional difficulties than did both normal-weight omnivores and vegetarians. In contrast, there were no significant differences between omnivore participants living with obesity and those in the other groups. Moreover, participants living with obesity had comparable emotion regulation abilities to normal-weight participants. These results suggest that emotion regulation deficits can more likely be explained by the presence of psychopathological traits than by being overweight or one's choice of diet.

### 1. Introduction

Vegetarian dietary patterns involve excluding foods of animal origin, and they are quantifiable on a continuum of dietary restrictions ranging from flexitarianism to fruitarianism [1,2]. The main diets within this category are veganism, which rejects all foods of animal origin, as well as the use of other animal products; vegetarianism, which excludes meat, poultry, and fish; and semi-vegetarianism, which excludes red meat [1,2]. It is estimated that between 2.8% and 8% of the total population in Europe have adopted a vegetarian diet [3], mainly for ethical,

health, or environmental reasons [1]. Meanwhile, in India, adopting a vegetarian diet is mainly motivated by spiritual and religious reasons [4], indicating vegetarian individuals' cultural, motivational, and psychological specificities [2].

Vegetarians have a lower body mass index (BMI) than omnivores and are less likely to be overweight [5]. Obesity, characterized by a BMI greater than or equal to 30, is a significant public health issue that affects between 6.2% and 28.3% of the adult population worldwide [6]. Since being overweight can cause physical and psychological problems and carry a significant mortality risk [7], studies have examined the effects

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of a vegetarian or vegan diet to reduce body weight in individuals living with overweighted or obesity [8–10]. Huang and colleagues [9] showed that individuals assigned to vegetarian diets (i.e., vegetarian and vegan) lost an average of 2.02 kg over a 9–74-week period compared with control participants on an omnivorous diet. Weight loss was greater when the adoption of the selective diet was concurrent with caloric restriction. This result has also been found in other interventional studies [8,10]. The authors of the studies [8–10] concluded that the recommendation of a vegetarian diet may be a therapeutic approach for weight loss in individuals living with overweighted or obesity, provided that caloric intake is also monitored. However, in these studies, weight loss remained minimal and not clinically significant; it may be more related to calorie restrictions than to the adoption of a vegetarian diet. Moreover, the psychological factors associated with overeating—and thereby an increased risk of developing and maintaining obesity—have not been assessed in vegetarian individuals living with obesity.

Dysfunctional eating styles include restrained eating (i.e., voluntarily restricting eating to maintain or lose weight [11]), emotional eating (i.e., turning to food in response to negative emotions [12]), and external eating (i.e., eating in response to external sensory stimuli without regard to internal hunger or satiety cues [13]). These eating styles are interrelated and positively correlated with BMI [14]. Moreover, some vegetarians, such as flexitarians and semi-vegetarians, engage in higher levels of restrained eating do omnivores, as their main motivation for adopting this diet is weight loss [15–17]. According to Macht [18], negative emotions reduce the ability of restrained eaters to deprive themselves because their cognitive resources are already mobilized by managing their emotions. These control failures are linked to excessive and uninhibited consumption of food underpinned by the presence of impulsive traits [19]. Impulsivity is characterized by acting without considering the consequences of an action [20].

Whiteside and Lynam [20] suggest that there are four impulsivity traits: negative urgency (i.e., engaging in impulsive behavior in response to negative affect), lack of premeditation (i.e., difficulty thinking and reflecting on the consequences of an act before action), lack of perseverance (i.e., inability to stay focused on a boring or difficult task), and sensation-seeking (i.e., tendency to enjoy exciting activities and openness to dangerous experiences). Impulsivity is positively related to BMI and dysfunctional eating styles [19–23], but, to our knowledge, this dimension has not yet been explored among vegetarians. The urgency trait is positively associated with emotional eating [22]; thus, the presence of negative emotions leads some individuals to overconsume, without considering the consequences, to regulate their negative emotions [24]. Emotional eating and impulsivity can be seen as maladaptive strategies for emotion regulation [20,25].

Emotion regulation (i.e., the ability to modulate one's emotions to meet the demands of the environment [26]) is associated with emotional competencies, commonly referred to as "emotional intelligence". These skills represent an individual's ability to identify, understand, express, regulate, and use their emotions and those of others [27]. Emotional intelligence is negatively associated with BMI [28]. In addition, "emotional eaters" are reported to have lower emotional intelligence and lower abilities to regulate their emotions [28]. They tend to channel their emotions into food, causing significant weight gain in the long term. In contrast, individuals with high levels of empathy (e.g., vegetarians [2]) have higher emotional skills [29]. Consequently, vegetarians should have more emotional competence than omnivores, but this has not yet been demonstrated.

In sum, BMI is positively correlated with dysfunctional eating styles and impulsivity (i.e., urgency, lack of perseverance), but negatively with emotional competencies (or namely "emotional intelligence"). The relationship between these dimensions of psychological functioning and vegetarian diets is poorly studied, while some researchers suggest that vegetarianism could be a therapeutic weight loss strategy for individuals living with overweighted or obesity. Indeed, few studies have shown that some vegetarians adopt this diet because they are motivated to

assert control over their weight, which may also be considered restrained eating. Thus, an increase in vegetarianism, especially among individuals living with obesity, raises questions about the psychological specificities of individuals who follow this diet. Thus, the main objective of the present study was to compare the dysfunctional eating styles, impulsivity, and emotional competence between four groups of participants: (a) vegetarians living with obesity, (b) omnivores living with obesity, (c) normal-weight vegetarians, and (d) normal-weight omnivores. The second objective was to assess the relationship between these variables and BMI across diet types in the participants living with obesity. We hypothesized that:

(H1) Participants living with obesity (omnivores and vegetarians) will exhibit more dysfunctional eating styles, as well as more impulsive traits, than normal-weight participants regardless of the diet (i.e., omnivore and vegetarian). Conversely, they would present less emotional competence than normal-weight individuals.

(H2) The same correlation patterns should be observed among participants living with obesity (omnivores and vegetarians): emotional regulation would be negatively associated with emotional eating and the impulsivity dimension "urgency".

## 2. Methods

### 2.1. Population

Between March 2018 and April 2020, 192 patients living with obesity were recruited from nutrition departments (Georges Pompidou European Hospital—Public Hospitals of Paris—, and Cognacq-Jay Foundation) and 588 individuals from the general population. The inclusion criteria for the participants were those who were aged between 18 and 66 years, were fluent in French, and provided voluntary informed consent. Concerning the exclusion criteria were having had bariatric surgery, being under protective custody, and for women, being pregnant. As a first step, we excluded 299 participants, of whom 182 did not complete all the questionnaires, 41 had a low BMI ( $< 18.5$ ), and 76 were living with overweighted ( $25 \leq \text{BMI} < 30$ ). We then excluded participants with current or past anorexia nervosa ( $n = 18$ ) and bulimia nervosa ( $n = 22$ ), as these disorders do not co-occur with obesity. In contrast, we kept participants presenting with a binge eating disorder (BED) for a better representation of the results, as this disorder is frequently reported among individuals living with obesity [30,31].

From the remaining sample of 441 participants, Group 1 was identified as individuals living with obesity ( $\text{BMI} \geq 30$ ) who followed a vegetarian diet ( $n = 12$ ; OB-veg). Then, three additional groups—consisting of age- and gender-matched participants—were created by diet type (i.e., vegetarian or omnivore). OB-omni participants were also matched according to the BMIs of OB-veg participants, and the same was done for normal-weight participants. Group 2 consisted of individuals living with obesity ( $\text{BMI} \geq 30$ ) who were omnivorous ( $n = 12$ ; OB-omni); Group 3 consisted of normal-weight individuals ( $18.5 < \text{BMI} < 25$ ) who were vegetarians ( $n = 12$ ; NW-veg); Group 4 consisted of normal-weight ( $18.5 < \text{BMI} < 25$ ) omnivores ( $n = 12$ ; NW-omni).

This group classification led to the further exclusion of 433 participants who did not meet the matching criteria. The final sample comprised 48 participants, 40 of whom were women with a mean age of 49.6 years ( $\pm 10.1$ ). Twenty-four participants living with obesity, and 24 were vegetarians.

### 2.2. Procedure

The research protocol was validated by the Research Ethics Committee (REC) of Paris Descartes University (N°2018–80). The study was presented to patients living with obesity consulting in a nutrition service; an information note was given and explained orally by an investigator who then checked the inclusion criteria. Participants underwent a diagnostic interview assessing eating disorders and then completed

self-questionnaires. Each patient was assigned a participant code to ensure anonymity and match the clinical interview data and the questionnaires.

Participants recruited from the general population were solicited through social networks and from the investigators' circle. Individuals interested in participating in the research were asked to contact the investigators by email. An appointment was then made by telephone or face-to-face to conduct the diagnostic interview. A link to the secure and anonymous LimeSurvey platform and an identification code were sent by email to the participants so that each one could complete the questionnaires.

## 2.3. Measures

### 2.3.1. Eating disorder diagnosis

The Mini International Neuropsychiatric Interview – 7th version [32] – is a structured interview for psychiatric diagnosis based on DSM-5 criteria [33]. The eating disorder module was used to assess the current or past presence of anorexia nervosa, bulimia nervosa, and binge eating disorder.

## 2.4. Sociodemographic and health information

An ad hoc questionnaire was developed to collect sociodemographic information (e.g., gender, age, marital status) and information about the participants' mental and physical health (e.g., counseling and medications for psychological difficulties, height, weight).

## 2.5. Dysfunctional eating styles

The Dutch Eating Behavior Questionnaire (DEBQ; [34]) assesses three dysfunctional facets of eating: restrained eating (i.e., voluntary limitation of eating to lose weight or keep it off), emotional eating (i.e., eating in response to negative emotions), and external eating (i.e., external stimuli, such as the smell of food, lead to food intake regardless of hunger or satiety). The participant is asked to respond to the 33 items via a five-point Likert scale with an additional response option for 11 items. In the present study, the questionnaire had good internal consistency (Cronbach's alpha's ranging from .77 for external eating to .96 for emotional eating).

## 2.6. Impulsivity

The Impulsive Behavior Scale (UPPS; [35]) measures the four personality traits underlying impulsivity [26]: urgency (i.e., engaging in impulsive behaviors to cope with negative affects), lack of premeditation (i.e., difficulty thinking and reflecting on the consequences of an act), lack of perseverance (i.e., difficulty staying focused on a challenging or boring task), and sensation seeking (i.e., openness to new experiences and tendency to enjoy and carry out exciting activities). The participant must answer the 45 items using a four-point Likert scale. In this study, the questionnaire had good internal consistency (Cronbach's alpha ranging from 0.76 for lack of perseverance to 0.87 for urgency).

## 2.7. Emotional competence

The Emotional Competence Profile (PEC; [36]) assesses the overall emotional competencies based on 50 items. These items are divided into two main factors, each comprising five sub-factors: intrapersonal emotional competence with as subfactors the ability to identify, understand, express, regulate, and use his or her own emotions and interpersonal competence with the ability to identify, understand, listen to, regulate, and use the emotions of others. The participant must answer the items using a five-point Likert scale. In the present study, the questionnaire had good internal consistency (Cronbach's alpha ranging from 0.83 for interpersonal skills to 0.90 for the total score).

## 2.8. Statistical analyses

Jamovi software was used to perform the statistical analyses. The significance level of  $p < .05$  was retained. Chi-square tests were calculated to compare the distribution of sociodemographic variables, health variables, and the presence of an eating disorder between the 4 groups (i.e., OB-veg, OB-omni, NW-veg, NW-omni). For the "age" variable and the clinical scale scores, Kruskal-Wallis tests and their Dwass-Steel-Critchlow-Fligner post hoc with the family-wise error rate protection were performed. Spearman correlations were performed between clinical scale scores and BMI, distinguishing between omnivores living with obesity from vegetarians living with obesity.

## 3. Results

### 3.1. Sociodemographic and health characteristics

The sociodemographic and health characteristics of the participants and the results of comparisons according to weight status (normal-weighted or obesity) and diet (vegetarian or omnivorous) are presented in Table A.1. A higher number of participants in the NW-veg and the NW-omni groups were parents ( $p = .045$ ) than those in the OB groups. A higher number of participants in the OB-veg presented with BED than those in the other groups ( $p = .022$ ). However, there was no difference in the distribution of the number of participants between the groups in terms of age, level of education, professional activity, consultation with a mental health professional, and use of medication for psychological difficulties.

### 3.2. Comparisons of clinical scale scores by weight status and diet

Comparisons of scale scores by weight status and diet are presented in Table A.2. The OB-veg group had a significantly higher emotional eating score than did the NW-omni group ( $p = .018$ ). There were no other significant differences in terms of dysfunctional eating styles or impulsive traits between the groups.

In terms of interpersonal emotional competence, the OB-veg group had a lower total level subscore than did the NW-veg group ( $p = .036$ ). Specifically, the OB-veg group had a lower score for identification, comprehension, and regulation of the emotions of other dimensions than NW-veg group ( $p$  values = .045, .036, and .035, respectively). Moreover, the OB-veg group obtained a lower score for the "listen to" and "regulation" dimensions than did the NW-omni group ( $p$  values = .033 and .014, respectively).

### 3.3. Relationship between the clinical scales and BMI according to diet in the participants living with obesity

Correlations analyses of the clinical scale scores and BMI were performed first for vegetarian participants living with obesity and then omnivore participants living with obesity. The findings are presented in Table A.3. In OB-veg and OB-omni groups, BMI was not significantly correlated with any clinical scale.

In both vegetarian and omnivore participants living with obesity, emotional eating was significantly and positively correlated with external eating (respectively  $r = 0.64$ ,  $p = 0.024$  in OB-veg group;  $r = 0.67$ ,  $p = .017$  in OB-omni group) and the urgency dimension of impulsivity ( $r = 0.83$ ,  $p < .001$  in OB-veg group;  $r = 0.74$ ,  $p = .006$  in OB-omni group).

Conversely, there was a significant positive correlation between emotional eating and lack of perseverance (impulsivity dimension) in OB-veg group ( $r = 0.62$ ,  $p = .032$ ) alone. Furthermore, intrapersonal emotional regulation was negatively associated with urgency (impulsivity dimension) in OB-veg group ( $r = -0.66$ ,  $p = .019$ ), whereas emotional regulation was negatively correlated with the lack of perseverance in OB-omni group ( $r = -0.61$ ,  $p = .035$ ). Likewise, emotional

**Table A.1**

Group comparisons for sociodemographic and health information according to diet and weight status.

	Total	Group 1:	Group 2:	Group 3:	Group 4:	Chi <sup>2</sup>	
	N = 48	OB-veg n = 12	OB-omni n = 12	NW-veg n = 12	NW-omni n = 12	Kruskal-Wallis	
						$\chi^2$ or H	p
<b>Sex n (%)</b>						0.00	1.000
Male	08 (16.7)	02 (16.7)	02 (16.7)	02 (16.7)	02 (16.7)		
Female	40 (83.3)	10 (83.3)	10 (83.3)	10 (83.3)	10 (83.3)		
<b>Age Mean (SD)</b>	49.6 (10.0)	50.0 (10.7)	50.5 (10.7)	49.2 (10.3)	48.6 (9.35)	0.59	.898
<b>Marital Status n (%)</b>						3.75	.290
Single	19 (39.6)	05 (41.7)	06 (50.0)	06 (50.0)	02 (16.7)		
Married	29 (60.4)	07 (58.3)	06 (50.0)	06 (50.0)	10 (83.3)		
<b>Child n (%)</b>						<b>8.05</b>	<b>.045</b>
Yes	33 (68.8)	06 (50.0)	06 (50.0)	10 (83.3)	11 (91.7)		
No	15 (31.3)	06 (50.0)	06 (50.0)	02 (16.7)	01 (8.3)		
<b>&gt;high school degree n (%)</b>						6.57	.087
Yes	38 (79.2)	10 (83.3)	09 (75.0)	07 (58.3)	12 (100)		
No	10 (20.8)	02 (16.7)	03 (25.0)	05 (41.7)	00 (000)		
<b>Professional activity n (%)</b>						8.38	.496
Employed	35 (72.9)	07 (58.3)	08 (66.7)	11 (91.7)	09 (75.0)		
Disability	03 (06.3)	01 (08.3)	02 (16.7)	00 (00.0)	00 (00.0)		
Unemployed	07 (14.6)	03 (25.0)	02 (16.7)	00 (00.0)	02 (16.7)		
Retired	03 (06.3)	01 (08.3)	00 (00.0)	01 (08.3)	01 (08.3)		
<b>Current eating disorder n (%)</b>						<b>9.60</b>	<b>.022</b>
Binge eating disorder	05 (10.4)	04 (33.3)	01 (08.3)	00 (00.0)	00 (00.0)		
No	43 (89.6)	08 (66.7)	11 (91.7)	100 (00.0)	100 (00.0)		
<b>Mental health care* n (%)</b>						1.77	.622
Yes	28 (59.6)	06 (54.5)	06 (50.0)	07 (58.3)	09 (75.0)		
No	19 (40.4)	05 (45.5)	06 (50.0)	05 (41.7)	03 (25.0)		
<b>Drug treatment for psy. problem* n (%)</b>						0.96	.811
Yes	19 (39.6)	06 (50.0)	05 (41.7)	04 (33.3)	04 (33.3)		
No	29 (60.4)	06 (50.0)	07 (58.3)	08 (66.7)	08 (66.7)		

Note: NW-omni: normal-weight omnivore participants; NW-veg: normal-weight vegetarian participants; OB-omni: omnivore participants living with obesity; OB-veg: vegetarian participants living with obesity; SD: standard deviation; vegetarian: includes all vegetarian food diets; \*: one missing value.

**Table A.2**

Group comparisons for psychometric scores according to diet and weight status.

	Total	Group 1:	Group 2:	Group 3:	Group 4:	Kruskal-Wallis		
	N = 48	OB-veg n = 12	OB-omni n = 12	NW-veg n = 12	NW-omni n = 12	H	p	Post hoc
	Mean (SD)							
<b>DEBQ</b>								
Restrained eating	3.10 (0.79)	3.29 (0.71)	3.23 (0.75)	2.90 (0.84)	2.99 (0.89)	1.70	.636	
Emotional eating	2.38 (1.09)	3.01 (1.10)	2.64 (1.19)	2.22 (0.89)	1.64 (0.71)	<b>10.25</b>	<b>.017</b>	1 > 4
External eating	2.87 (0.67)	3.10 (0.81)	2.61 (0.68)	2.84 (0.53)	2.92 (0.60)	5.54	.136	
<b>UPPS</b>								
Urgency	26.9 (7.35)	30.8 (9.94)	25.8 (6.72)	27.1 (6.44)	24.2 (4.41)	4.39	.222	
Lack of premeditation	22.6 (5.88)	24.7 (7.60)	23.3 (6.44)	22.2 (2.41)	20.1 (5.50)	4.27	.234	
Lack of perseverance	19.2 (5.02)	21.4 (4.96)	19.4 (4.52)	18.0 (3.72)	17.8 (6.32)	3.71	.295	
Sensation seeking	26.8 (7.78)	24.3 (6.26)	27.2 (7.48)	31.8 (8.23)	23.8 (7.65)	7.34	.062	
<b>PEC</b>								
Total	3.48 (0.55)	3.14 (0.60)	3.34 (0.59)	3.77 (0.41)	3.66 (0.39)	<b>8.04</b>	<b>.045</b>	NS
Intrapersonal	3.54 (0.59)	3.33 (0.52)	3.36 (0.71)	3.79 (0.46)	3.70 (0.52)	4.78	.189	
Identification	3.73 (0.79)	3.70 (0.78)	3.65 (0.94)	3.78 (0.70)	3.78 (0.81)	0.07	.996	
Comprehension	3.69 (0.92)	3.35 (0.78)	3.60 (1.11)	3.85 (0.73)	3.97 (0.99)	4.07	.254	
Expression	3.58 (0.81)	3.20 (0.92)	3.25 (0.99)	3.92 (0.38)	3.93 (0.48)	<b>8.94</b>	<b>.030</b>	NS
Regulation	3.24 (0.83)	3.02 (0.74)	3.25 (0.91)	3.67 (0.69)	3.03 (0.91)	5.50	.139	
Utilization	3.48 (0.85)	3.37 (0.67)	3.03 (0.83)	3.72 (0.94)	3.78 (0.82)	5.24	.155	
Interpersonal	3.41 (0.63)	2.95 (0.72)	3.33 (0.58)	3.75 (0.48)	3.62 (0.43)	<b>10.65</b>	<b>.014</b>	3 > 1
Identification	3.78 (0.81)	3.25 (0.95)	3.77 (0.72)	4.18 (0.61)	3.93 (0.71)	<b>8.04</b>	<b>.045</b>	3 > 1
Comprehension	3.68 (0.77)	3.13 (0.68)	3.60 (0.71)	4.00 (0.64)	4.00 (0.80)	<b>10.43</b>	<b>.015</b>	3 > 1; 4 > 1
Listen to	3.73 (0.93)	3.05 (1.04)	3.53 (1.05)	4.02 (0.49)	4.32 (0.55)	<b>11.09</b>	<b>.011</b>	4 > 1
Regulation	3.20 (0.80)	2.70 (0.83)	3.33 (0.96)	3.57 (0.50)	3.20 (0.64)	7.03	.071	3 > 1
Utilization	2.66 (0.92)	2.60 (1.00)	2.42 (0.81)	2.97 (0.99)	2.65 (0.90)	2.38	.497	

Note: Only significant results of Dwass-Steel-Critchlow-Fligner post hoc tests were indicated. DEBQ: Dutch Eating Behavior Questionnaire; NS: No Significant results of post hoc tests; NW-omni: normal-weight omnivore participants; NW-veg: normal-weight vegetarian participants; OB-omni: omnivore participants living with obesity; OB-veg: vegetarian participants living with obesity; PEC: Profile of Emotional Competence; SD: standard deviation; UPPS: Impulsive Behavior Scale; vegetarian: includes all vegetarian food diets.

**Table A.3**  
Correlation matrix between BMI and psychometric scores according to diet in the participants living with obesity.

Subscales	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. BMI	–	–	–0.32	–0.06	–0.23	–0.31	0.03	0.26	–0.25	0.20	–0.02	–0.40
DEBQ		0.01	–0.42	–0.20	–0.36	–0.24	–0.19	–	–0.14	0.06	0.28	–0.34
			0.13	<b>0.64 *</b>	<b>0.83 ***</b>	0.55	<b>0.62 *</b>	0.26	–0.07	–0.33	–0.48	0.14
			0.08	<b>0.67 *</b>	<b>0.60 *</b>	0.22	0.55	<b>0.60 *</b>	–0.25	–0.38	–0.49	–0.18
UPPS			0.23	<b>0.74 **</b>	0.34	<b>0.77 **</b>	<b>0.73 **</b>	0.54	–0.38	<b>–0.63 *</b>	<b>–0.66 *</b>	–0.13
			0.01	0.55	<b>0.61 *</b>	0.46		0.21	–0.50	<b>–0.74 *</b>	–	–0.16
			0.07	0.49	0.22	0.54	0.56		–0.50	<b>0.58°</b>	–0.50	–0.40
			0.15	–0.03	–0.21	0.42	0.40	0.12	–0.05	–0.08	–0.13	–0.04
PEC			–	<b>–0.67 *</b>	–0.38	<b>–0.77 *</b>	–0.33	<b>–0.68 *</b>	0.01		<b>0.78 **</b>	<b>0.92 *</b>
			0.18	0.13	*	*	*	*				**
			–	<b>–0.70 *</b>	–0.49	<b>–0.72 *</b>	–0.35	–0.56	0.01	<b>0.90 **</b>	<b>0.63 *</b>	0.55
			0.25	0.19		*				**		
			0.01	<b>–0.74 *</b>	<b>–0.58</b>	<b>–0.55°</b>	<b>–0.61</b>	<b>–0.61</b>	0.04	<b>0.64 *</b>	<b>0.73 **</b>	0.30
			–	*	*	*	*	*				
			–	<b>–0.64 *</b>	–0.25	<b>–0.64 *</b>	–0.07	–0.46	0.21	<b>0.91 **</b>	<b>0.75 **</b>	0.55
			0.08	0.01						**		

Note: The area above the diagonal indicates the correlations in vegetarian participants living obesity and the area below the correlations in omnivore participants living obesity. DEBQ: Dutch Eating Behavior Questionnaire; PEC: Profile of Emotional Competence; UPPS: Impulsive Behavior Scale;  $p = .066^{\circ}$ ;  $p = .050^{\circ}$ ;  $p < .05^*$ ;  $p < .01^{**}$ ;  $p < .001^{***}$ .

eating was negatively correlated with intrapersonal emotion skills of identification ( $r = -0.71, p = .010$ ), comprehension ( $r = -0.66, p = .019$ ), emotional expression ( $r = -0.66, p = .019$ ), and regulation ( $r = -0.74, p = .006$ ) in OB-omni group alone.

#### 4. Discussion

From an exploratory perspective, the main objective of this study was to compare dysfunctional eating style, impulsive traits, and emotional competence in omnivorous and vegetarian participants while considering their weight status, to determine obesity-related specificities. The second objective was to explore the relationship between these dimensions of psychological functioning and BMI according to diet types of participants living with obesity.

While several studies have shown that individuals living with obesity present restrained eating, emotional eating, and external eating [11–14, 18], only one difference in dysfunctional eating behaviors was observed in this study. The OB-veg participants tended to eat to cope with negative emotions compared to the NW-omni group. In line with other studies [e.g., 21], there were positive correlations between "emotional eating" and impulsive trait "urgency" and between "urgency" and "intrapersonal emotion regulation" in both OB-veg and OB-omni groups. In contrast, emotional eating was not correlated with emotion regulation in the OB-veg group, whereas it was in the OB-omni group. These results partly support that impulsivity and emotional eating can be equated with dysfunctional emotional regulation strategies [20,24]. Turning to food to regulate negative emotions could be one of the behaviors underlying the impulsive urgency trait. However, OB-veg participants seemed to prefer to use other impulsive behaviors to regulate their emotions. Engaging in emotional eating would not allow vegetarians living with obesity to regulate their negative affect, but instead, it could promote episodes of overeating.

Contrary to several studies that have shown that individuals living with obesity have more emotional difficulties than normal-weight individuals do [22], in the present study, the OB-veg and NW-omni groups differed in terms of emotional competence alone. The OB-veg group consisted of four participants with BED, compared to just one in the OB-omni group. Individuals living with obesity and BED exhibit more

dysfunctional eating styles, impulsive traits, and emotional difficulties than individuals living with obesity without BED [24,25,35]. Therefore, the differences between vegetarians living with obesity and normal-weight omnivores and vegetarians were likely due to the particularities of the eating disorder itself, especially since there was no difference between OB-veg and normal-weight participants. Impulsivity and emotional difficulties do not appear to be specific to obesity, but rather to other components that influence it (e.g., dysfunctional eating styles, binge eating). These functional characteristics are also not associated with a specific diet. Prescribing a vegetarian diet to individuals living with obesity, therefore, may not be a viable therapeutic approach to weight loss and/or the prevention of associated complications (e.g., type II diabetes [8–10], as it leads to limited and clinically insignificant weight loss in the long term.

The results of this study should be interpreted with caution owing to the study's limitations. The main limitation is the size of the matched groups. Since the number of participants living with obesity who were vegetarians was small ( $n = 12$ ), we had to match the remaining participants according to their gender, age, and BMI (participants living with obesity with participants living with obesity and normal-weight participants with normal-weight participants) to group the participants. The small size of groups may have smoothed out the differences in dysfunctional eating styles by weight status that are well established in the literature (e.g., [14]). Moreover, the differences observed between OB-veg and other groups may be attributable to the inclusion of participants living with BED. Therefore, it is appropriate to replicate this study by distinguishing individuals with an eating disorder from those without one. Finally, it was not possible to differentiate participants according to their type of vegetarian diet (i.e., flexitarian, semi-vegetarian, vegetarian, vegan) even though it may be accompanied by motivational (e.g., weight loss motivation for semi-vegetarians) and psychological (e.g., cognitive restriction) specificities [2].

This preliminary study needs to be replicated using a larger sample to verify the results. Although several randomized studies have shown that adherence to a prescribed diet does not differ from a self-selected diet in terms of food consumption [8–10,38], particular attention should be paid to the modalities of compulsion to follow a specific diet. Indeed, if a certain type of diet is followed from a weight control perspective (i.e., a

higher level of cognitive restriction), then rigid adherence to a diet may be associated with the development or maintenance of eating disorders such as BED [37]. Both self-imposed and imposed dietary restrictions (e.g., disease) may be associated with binge eating behaviors [11,18]. Therefore, it is important to be careful when mentioning dietary modifications to individuals living with obesity, as well as their motivation to follow vegetarian diets in order, to offer interventional support (e.g., mindfulness [39]) if they experience hyperphagic episodes. Furthermore, it is also necessary to assess the duration of the adoption of a diet, as motivations for following a vegetarian diet tend to change over time [2]. Thus, the difficulties encountered at the beginning of the diet may diminish.

## 5. Conclusion

Vegetarians living with obesity exhibited more emotional eating and emotional difficulties than normal-weighted individuals. Individuals living with obesity had comparable emotional regulation abilities to normal-weighted participants, suggesting that deficits in emotional regulation are explained more by the presence of psychopathological traits (i.e., dysfunctional eating styles, binge eating disorder) than by being obesity or choosing a vegetarian diet. Motivation and the goals pursued in adopting a vegetarian diet could explain the differences between omnivorous and vegetarian individuals. This motivational aspect should be investigated in future studies, mainly to prevent possible dysfunctional eating behaviors.

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## Ethical Statement

This study was declared and approved by the local ethics committee (CER-Paris Descartes N°2018–80).

## CRedit authorship Contribution statement

**Eva Hanras:** Acquisition of data, Formal analysis, Investigation, Data curation, Writing – original draft. **Emilie Boujut:** Writing – original draft. **Alexis Ruffault:** Conceptualization, Methodology, Data curation, Supervision, Project administration. **Diane Messenger:** Resources, Writing – review & editing. **Claire Rives-Lange:** Resources, Writing – review & editing. **Claire Carette:** Resources, Writing – review & editing. **Léa Lucas-Martini:** Resources, Writing – review & editing. **Sébastien Czernichow:** Resources, Writing – review & editing. **Géraldine Dorard:** Conceptualization, Methodology, Writing – review & editing, Supervision, Project administration.

## Data availability

Data and statical codes will be provided upon request to the authors.

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