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**ORIGINAL ARTICLE IN BEHAVIORAL PSYCHOLOGY**

**Emotion dysregulation and loneliness as predictors of food addiction**

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**Abstract**

**Introduction:** This study aimed to investigate whether multiple aspects of emotiondysregulation contribute to the etiology of Food Addiction (FA); as well as to provide further evidence and clarity regarding the role of loneliness on the development of addictive behaviour towards food.

**Methods:** A correlational study was employed to assess associations within 162 participantswhich were recruited via online forums on FA and student population. The Yale Food Addiction Scale (YFAS), Difficulties in Emotion Regulation Scale (DERS), and UCLA Loneliness Scale, and a demographic and personal information questionnaire were all completed online. A Poisson regression analysis was carried out and statistical significance

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was set at P <0.05.

**Results:** 79% of the sample endorsed a persistent desire or repeated, unsuccessful attempts tocut down or control their use of highly processed foods, while 21% met diagnostic criteria for food addiction. Poisson regression analysis demonstrated that the model predicts food addiction (*P* <0.001). Specifically, food addiction symptom count was positively predicted by difficulty engaging in goal-directed behaviour, impulse control difficulties, lack of emotional awareness and limited access to emotion regulation strategies (*P* <0.05); DERS total, nonacceptance of emotional responses and lack of emotional clarity were not significant predictors. Loneliness positively predicted food addiction (*P* =0.002).

**Discussion and Conclusions:** The findings of this research provide further evidence on theetiology of food addiction, as multiple aspects of emotion dysregulation, including difficulty in engaging in goal-directed behaviour, impulsiveness, emotional awareness and limited access to emotion regulation strategies, and loneliness were found to influence the development of an addictive behaviour towards certain types of food. Future research will need to understand possible causality between these factors and insights into the potential role addictive behaviour of food has in overeating phenomena, such as binge-eating.

**KEY WORDS:** Addictive behaviours; food addiction; emotional dysregulation; loneliness;unhealthy eating habits.

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**Riassunto**

**Introduzione:** Questo studio ha cercato di comprendere se i molteplici aspetti delladisregolazione emotiva contribuiscano all’insorgenza della dipendenza alimentare, cosi come di fornire ulteriore evidenza e chiarezza sul ruolo della solitudine nello sviluppo della dipendenza alimentare.

**Metodi:** Uno studio correlazionale è stato adottato per valutare le associazioni esistenti nei 162partecipanti che sono stati recrutati attraverso i forum online sulla dipendenza alimentare e la popolazione studentesca. I questionari Yale Food Addiction Scale (YFAS), Difficulties in Emotion Regulation Scale (DERS) ed UCLA Loneliness Scale, oltre ad un questionario informativo sui dati individuali e demografici dei partecipanti sono stati completati online. Un modello di regressione di Poison è stato adottato e la significatività statistica è stata fissata pari a P <0.05.

**Risultati:** Il 79% del campione ha confermato un persistente desiderio o ripetuti tentativi infruttuosi diridurre o di controllare l’uso di prodotti alimentari molto elaborati, mentre il 21% ha soddisfatto i criteri diagnostici della dipendenza alimentare. La regression di Poisson ha dimostrato che il modello predice la dipendenza alimentare (*P* <0.001). Specificamente, il numero di sintomi di dipendenza alimentare è stato positivamente predetto dalla difficiltà ad impegnarsi in una condotta finalizzata, dalla difficoltà a controllare l’impulso, dalla mancanza di consapevolezza emozionale e dal limitato accesso alle strategie di regolazione emotiva (*P* <0.05); il totale del punteggio della scala DERS, la non accettazione delle risposte emozionali e la mancanza di serenità emotiva non sono stati predittori significativi. La solitudine ha predetto positivamente la dipendenza alimentare (*P* =0.002).

**Discussione e Conclusioni:** I risultati di questa ricerca forniscono ulteriore evidenza

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sull’eziologia della dipendenza alimentare, dal momento che è stato scoperto che i molteplici aspetti della disregolazione emotiva, inclusa la difficoltà ad impegnarsi in condotte finalizzate, l’impulsività, la consapevolezza emozionale ed il limitato accesso alle strategie di regolazione emotive, così come la solitudine influenzano lo sviluppo di un comportamento additivo verso certi tipi di alimenti. In future la ricerca avrà il bisogno di capire il possible rapporto causale tra questi fattori e di intuire il potenziale ruolo rispetto al comportamento additivo che ha il cibo nei fenomeni di eccesso alimentare come l’impulso incontrollato ad alimentarsi.

**TAKE-HOME MESSAGE:** The risk of developing addictive tendencies towards food can beinfluenced and predicted by the cognitive artefacts including emotional regulation and loneliness. Greater insight provided by this research concerning these contributory factors, is essential for developing evidence-based approaches to supporting people living with these challenges.

**Competing interests:** none declared

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**INTRODUCTION**

Food addiction (FA) is described as an excessive consumption of hyperpalatable foods [1, 2]; however, the conceptualization of food addiction as a behavioural or substance addiction is still debatable [3–6]. Proposed assessment criteria for FA were developed in parallel with the criteria for substance disorders, including: tolerance, withdrawal, consuming larger amounts or over a longer period than intended, persistent desire or unsuccessful efforts to reduce consumption, much time spent obtaining, using, or recovering from the effects of consumption, giving up or reducing important activities because of consumption, and clinically significant impairment or distress [7]. Additionally, the FA hypothesis suggests that some forms or aspects of problematic and/or compulsive eating behaviour are the result of an addiction to highly processed foods that are typically high in added sugar, fat and salt [8–10]; and the ‘addictive appetite’ model of binge-eating behaviour highlights that the desire and craving for hyperpalatable food is due to the increased incentive salience of food cues and habitual response patterns to them [11, 12].

The concept of FA has striking bio-behavioural parallels to drug abuse, and highly palatable foods rich in sugar, fat and salt have an abuse potential similar to addictive drugs [13–18]. Both food and drug cues activate similar brain regions, such as the amygdala and orbitofrontal cortex [19, 20], increase dopamine metabolism [16, 21–23], and alter the activity of reward circuits in the central nervous system [24–26]. Given the similarities between FA and drug addictions, it is reasonable to assume that they may share salient etiological variables, including difficulties in emotion regulation, commonly known as an emotion dysregulation, that is, the extent to which individuals do not possess the skills necessary to regulate and control negative affect or

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emotional distress [27]. Empirical research indicates that emotion dysregulation plays a key role in the development of FA, as people who have difficulties in controlling and/or managing their eating habits during stressful events are more likely to show addictive behaviour towards food [28–30].

Innamorati and colleagues [29] examined the relationship between FA, emotion dysregulation and mentalization deficits in a non-clinical cohort. A sample of Italian adults were assessed by the Yale Food Addiction Scale (YFAS) [31] for FA symptoms, the Difficulties in Emotion Regulation scale (DERS) [32] for emotion dysregulation and by the Mentalization Questionnaire (MZQ) [33] for mentalization – i.e., the ability to represent and understand inner mental states in oneself and others. They found that high food-addiction symptoms were associated with mentalization deficits and with all DERS subscales except for the lack of emotional awareness and goals subscales. Further multivariate analysis, however, revealed that high food-addiction symptoms were independently associated with mentalization deficits, but not with difficulties in emotion regulation, suggesting that FA and difficulties in emotion regulation could be mediated by other variables, such as body mass index (BMI) and binge-eating severity.

Pivarunas and Conner [30] provide further support on the positive association between emotion dysregulation and FA. They investigated the associations between impulsivity, emotion dysregulation and FA in a large cohort of undergraduate students. FA was assessed by YFAS [31], impulsivity was assessed via the UPPS-P Impulsive Behaviour scale [34, 35] and the DERS

1. was used to assess emotion dysregulation. Findings provide evidence on the role impulsive behaviour and emotion dysregulation has on the development and/or maintenance of FA. However, although the finding on emotion dysregulation provides empirical support in the area

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of FA, the authors did not explore multiple aspects of emotion dysregulation, as the finding was gathered via the overall scale.

Considering the similarities between FA and eating psychopathology, additional support on the relationship between emotion regulation and self-reported occurrence of FA traits is provided by eating-related literature, which suggests that people change their eating habits as a response to negative emotions [36–39]. Research has shown that people who are under stressful situations are more likely to eat more snack-type food [40–42], chocolate [43–45] and sweet foods [46]. Moreover, food intake and/or feeding behaviour can be either increased or reduced during stress or negative affect [36, 42] depending on the types of external and/or psychological stressors [42, 47]. Empirical studies using DERS to examine any possible associations between emotion dysregulation and eating psychopathology indicated that individuals, especially women, with eating disorders symptomatology demonstrate higher DERS scores [48–50]. Therefore, levels of emotion regulation are suggested to play a crucial role on the etiology of an addictive behaviour towards food.

Another factor that might have a connection with an addictive behaviour is loneliness, as it has been identified as a contributor to the development of substance use [51–53] and behavioural addictions, such as internet addiction [54–57] and FA [58, 59]. A recent study by Dincyurek et al.

1. investigated the relationship between impulsivity, loneliness and FA within University students. 216 male and 160 female students were examined using the Turkish versions of YFAS to assess FA characteristics, the UCLA Loneliness Scale [60] to measure loneliness and the Barratt Impulsiveness Scale to examine impulsivity. Researchers found strong positive associations between FA and loneliness, and FA and impulsivity, where high levels of loneliness

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(and impulsivity) were related with addiction-like eating habits. This finding provides fruitful implications for the negative affect loneliness has on developing an addictive behaviour towards certain types of food. In addition, Tatsi et al. [59] explored whether loneliness is associated with FA and the mediating effect impulsivity and emotion dysregulation might has on this relationship. Findings provided important implications of the relationship between loneliness and FA, which was unrelated when controlling by the overall effect of impulsivity and emotion dysregulation.

Additionally, the consequences of negative life events can cause loneliness, which can result in isolating oneself from social groups. The potential long-term consequences of withdrawal from social contact (e.g., losing a relationship) are stressors that cause dysphoria [61]. Moreover, eating-related literature suggests that loneliness and/or social isolation predict unhealthy eating behaviours, compulsive eating and eating pathology [62–64], which are characteristics that can be found in individuals with FA [1, 2, 8, 38]. A study by Southward et al. [63] investigated the mediating effect loneliness might have on the relationship between emotion dysregulation and bulimia nervosa/binge eating. A sample of 107 women with bulimia nervosa or binge-eating disorder were assessed via the UCLA Loneliness Scale [60] and DERS [32]. Findings indicated that loneliness is directly associated with bulimia nervosa/ and binge-eating, as well as having a mediating role on the relationship between emotional dysregulation and unhealthy eating behaviours. Therefore, loneliness is considered as another contributor to the development of an addictive behaviour on hyperpalatable foods.

Although evidence for the concept of FA has been steadily growing [65], there is limited empirical research to provide insights into this phenomenon and the factors that predict increased

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risk of FA. The parallels between FA and substance and/or behavioural addictions, and the similarities between FA and unhealthy eating behaviours [66], suggest empirical research is required to provide further insights into the development of FA including the factors that predict increased risk of FA. In addition, loneliness has long been known to increase vulnerability to an addiction [52, 55, 67]; however, it has been neglected in FA research. To address the shortcomings apparent within the existing literature, the present study seeks to examine whether multiple aspects of emotion dysregulation contribute to the etiology of FA; as well as to provide further evidence and clarity regarding the role of loneliness on the development of addictive behaviour towards food.

**METHODS**

***Study participants, procedures and design***

From a total of 262 recruited individuals, 162 (61.8%) met the inclusion criteria of being over the age of 18 years, suffering no medical condition and/or currently taking medication, and fluency in English language. To capture a diverse sample, participants were recruited via online forums on FA (e.g., Food Addicts in Recovery Anonymous) and student population, by a probabilistic sampling. Table 1 presents sample characteristics.

**Table 1.** Demographic sample characteristics of age, sex, BMI, and ethnicity.



Age



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| *N* | Minimum | Maximum | *M* | *S* |
| 162 | 18 | 85 | 34.80 | 12.78 |
| Sex |  |  |  |  |
|  | Female | Male | Other | Total |
| *N* (Percent) | 136 (84.0) | 25 (15.4) | 1 (0.6) | 162 (100.0) |
| BMI class |  |  |  |  |

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|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Under- weight | Norma | Overweight | Obese | Missin | Total |
| *N* (Percent) | 6 (3.8) | 7 | 7 | 35 (21.6) | 42 (25.9) | 2 (1.2) | 162 (100.0) |
| BMI (160, *M =* 27.78, *SD =* 9.76) |  |  |  |  |  |
| Ethnicity |  |  |  |  |  |  |  |
|  | White |  |  | Other | Missing |  | Total |
| *N*(Percent) | 123 (75.9) |  |  | 34 (21.0) | 5 (3.1) |  | 162 (100.0) |

*Note:* BMI classes according to World Health Organization classification [68].

After giving informed consent, participants were instructed to complete a series of self-report measures. The study adhered to the British Psychological Society’s ethics guidelines [69–71], complied with the World Medical Association Declaration of Helsinki [72] and was approved by an ethics committee of the University of Derby.

This study followed a correlational design, where traits of emotion dysregulation and loneliness were used as predictors, and a count of the number of symptoms endorsed on FA was used as an outcome variable.

*Measures*

*Demographic & Personal Information Questionnaire*

Participants’ characteristics were gathered via a ‘Demographic & Personal Information’ questionnaire. Questions referring to participants’ age, sex and ethnic background together with questions asking about current medical condition and/or the use of a medication were included. Height and weight measures were subsequently used to calculate participants´ body mass index

(BMI = kg/m2).

*Yale Food Addiction Scale (YFAS) [31]*

FA was assessed via the YFAS, a measure assessing addictive eating behaviour and/or symptoms for substance dependence as stated in the DSM-IV [73] towards certain foods high in sugar, salt,

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fat, or starches in the past year. This 25-item self-report measure includes a mixture of response categories. On 16 items, a Likert-type format is ranked from 0 (Never) to 4 (4 or more times or daily); 8 items are dichotomous (0 = no, 1 = yes) and the final item is answered from 1 (or fewer times) to 5 (or more times). Following the scoring instructions by Meule and Gearhardt [74], all items were dichotomised to indicate whether the diagnostic criterion corresponding to a given item was positively endorsed. Then, a continuous symptom count (score should range from 0 symptoms to 7 symptoms) was calculated by summing the number of endorsed criteria. The YFAS showed good internal reliability in the current sample (α = .92).

*Difficulties in Emotion Regulation Scale (DERS) [32]*

Multiple aspects of emotion dysregulation were assessed by the DERS. This is a 36-item scale with five response options ranging from 1 (Almost never) to 5 (Almost always). The scale consists of six subscales:

1. Nonacceptance of emotional responses (NONACCEPT, α = .92): Someone’s tendency toward negative secondary responses to negative emotions, and/or denial of distress (e.g., *When I’m upset, I become angry with myself for feeling that way*).
2. Difficulty engaging in goal-directed behaviour (GOALS, α = .92): Identifies problems in concentrating and accomplishing tasks while experiencing negative emotions (e.g., *When I’m upset, I have difficulty getting work done*).
3. Impulse control difficulties (IMPULSE, α = .93): Identifies behaviours when someone struggles to control behaviour when upset (e.g., *I experience my emotions*

iv)

*as overwhelming and out of control*).

Lack of emotional awareness (AWARENESS, α = .86): Captures someone’s

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inattention to emotional responses (e.g., *I pay attention to how I feel-* Reversed Item).

1. Limited access to emotion regulation strategies (STRATEGIES, α = .93): Captures someone’s beliefs that there is little a person can do to regulate one’s emotions effectively after becoming upset (e.g., *When I’m upset, I believe that I will remain* *that way for a long time*).
2. Lack of emotional clarity (CLARITY, α = .88): Identifies the extent to which individuals are unclear about which emotions they are experiencing. (e.g., *I have no*

*idea how I am feeling*).

These subscales combine to indicate the overall emotional dysregulation scale (α = .96), with higher scores signifying greater emotional dysregulation.

*UCLA Loneliness Scale [60]*

Loneliness and feelings of social isolation were assessed by the UCLA Loneliness scale, which showed good internal reliability (α = .96). This is a 20-item scale (e.g., *How often do you feel* *alone?*) in which participants respond from 1 (Never) to 4 (Always). Higher scores indicatehigher loneliness and greater perceived social isolation.

***Statistical analysis***

Preliminary analyses were performed to ensure no violation of the assumptions of normality and/ or any indication of univariate/multivariate outliers. Following preliminary analyses, regression was used to test the data. The outcome variable in this study was a count of the number of symptoms endorsed on YFAS, while traits of emotion dysregulation and loneliness were used as the predictors. Due to the nature of the outcome variable (count data; less than its mean), a

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Poisson regression analysis was performed. Statistical significance was set at P <0.05.

**RESULTS**

***Preliminary analyses***

Data (*n* = 162) were analysed for outliers and normality. There was no evidence of outliers and results indicated that data were normally distributed. Descriptive statistics for all variables are presented in Table 2 and correlations in Table 3.

**Table 2.** Descriptive statistics of predictor and outcome variables (*n =*162).



|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Minimum | Maximum | *M* | *SD* | VIF |
| YFAS Symptom count | 0.00 | 5.00 | 1.2 | 1.57 |  |
| DERS\_Total | 42.00 | 162.00 | 87.10 | 28.18 | 2.72 |
| DERS\_NONACCEPT | 5.00 | 30.00 | 14.17 | 6.41 | 2.64 |
| DERS\_GOALS | 5.00 | 25.00 | 14.93 | 5.19 | 2.52 |
| DERS\_IMPULSE | 6.00 | 30.00 | 13.10 | 5.88 | 2.74 |
| DERS\_AWARENESS | 6.00 | 30.00 | 14.77 | 5.08 | 1.79 |
| DERS\_STRATEGIES | 8.00 | 39.00 | 19.22 | 8.25 | 2.02 |
| DERS\_CLARITY | 5.00 | 23.00 | 10.91 | 4.25 | 2.91 |
| UCLA\_Total | 23.00 | 75.00 | 47.70 | 12.26 | 1.97 |

Per Table 3, all factors were positively correlated at 0.01 and 0.05 significance level.

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**Table 3.** Correlations of predictor and outcome variables (*n*= 162).



|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | YFAS | DERS\_To DERS\_ | DERS | D E R S \_ | DERS\_ | DERS\_ | DERS | UCLA\_To |
|  | Sympto | tal | NONACCE | \_ | IMPULS | AWARENE | STRATEGI | \_ | tal |
|  | m |  | PT | G O A | E | SS | ES | CLAR |  |
|  | count |  |  | LS |  |  |  | ITY |  |
|  |  |  |  |  |  |  |  |  |  |
| YFAS | - |  |  |  |  |  |  |  |  |
| Symptom |  |  |  |  |  |  |  |  |  |
| count |  |  |  |  |  |  |  |  |  |
| DERS\_ | .496\*\* | - |  |  |  |  |  |  |  |
| Total |  |  |  |  |  |  |  |  |  |
| DERS\_ | .411\*\* | .842\*\* | - |  |  |  |  |  |  |
| NONACCE |  |  |  |  |  |  |  |  |  |
| PT |  |  |  |  |  |  |  |  |  |
| DERS\_ | . 416\*\* | .794\*\* | .652\*\* | - |  |  |  |  |  |
| GOA LS |  |  |  |  |  |  |  |  |  |
| DERS\_ | .434\*\* | .841\*\* | .633\*\* | . | - |  |  |  |  |
| IMPULSE |  |  |  | 675\*\* |  |  |  |  |  |
| DERS\_ | .276\*\* | .552\*\* | .328\*\* | .202\* | .304\*\* | - |  |  |  |
| AWARENE |  |  |  |  |  |  |  |  |  |
| SS |  |  |  |  |  |  |  |  |  |
| DERS\_ | .467\*\* | .914\*\* | .757\*\* | . | .740\*\* | .351\*\* | - |  |  |
| STRATEGI |  |  |  | 720\*\* |  |  |  |  |  |
| ES |  |  |  |  |  |  |  |  |  |
| DERS\_ | .327\*\* | .793\*\* | .537\*\* | . | .610\*\* | .617\*\* | .654\*\* | - |  |
| CLAR ITY |  |  |  | 489\*\* |  |  |  |  |  |
| UCLA\_ | .436\*\* | .687\*\* | .567\*\* | . | .534\*\* | .404\*\* | .638\*\* | . | - |
| Total |  |  |  | 519\*\* |  |  |  | 592\*\* |  |
|  |  |  |  |  |  |  |  |  |  |

*Note:* \*. Correlation is significant at the 0.05 level (2-tailed). \*\*. Correlation is significant at the

0.01 level (2-tailed)

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A majority of the sample, 79% (*n* = 128), endorsed a persistent desire or repeated, unsuccessful attempts to cut down or control their use of highly processed foods that are typically high in added sugar, fat and/or salt; while 21% of the sample (*n* = 34) met diagnostic criteria for FA, endorsing at least three symptoms. Multicollinearity was not an issue, as all the VIFs are less than 3 [75].

Screening the data for any possible associations between FA and BMI, analysis indicates a positive association rs (160) =.350, *P* <0.01 supporting previous studies [76, 77].

**Poisson Regression**

Poisson regression was run to explore whether emotion dysregulation (DERS\_Total) and its six subscales (NONACCEPT, GOALS, IMPULSE, AWARENESS, STRATEGIES, CLARITY), and loneliness (UCLA) predict food addition (YFAS symptoms count).

Direct effects were significant, omnibus χ 2=91.102, df=7, *P* =0.001. The following

emotion dysregulation traits: difficulties in engaging in goal directed behaviour (DERS\_GOALS), impulsive control difficulties (DERS\_IMPULSE), lack of emotional awareness (DERS\_AWARENESS) and limited access to emotion regulation strategies (DERS\_STRATEGIES) significantly positively predicted YFAS symptom count. Overall emotion dysregulation (DERS\_Total), non-acceptance of emotional responses (DERS\_NONACCEPT) and lack of emotional clarity (DERS\_CLARITY) did not predict YFAS symptom count. Loneliness (UCLA) was a significant positive predictor of YFAS symptom count. Please refer to Table 4 for details.

**Table 4.** Poisson regression results – YFAS Symptoms count, DERS & UCLA.

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|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | B | SE | 95% Wald CI | 2 | *p* |
|  |  |  |  | Wald χ |  |
|  |  |  |  |  |  |
| DERS\_Total | .049 | .0249 | -.097-.000 | 3.816 | *.051* |
| DERS\_NONACCEPT | .046 | .0283 | -.010-.101 | 2.620 | *.106* |
| DERS\_GOALS | .088 | .0328 | .023-.152 | 7.165 | *.007* |
| DERS\_IMPULSE | .071 | .0326 | .007-.135 | 4.684 | *.030* |
| DERS\_AWARENESS | .088 | .0348 | .019-.156 | 6.336 | *.012* |
| DERS\_STRATEGIES | .076 | .0338 | .010-.142 | 5.074 | *.024* |
| DERS\_CLARITY | .031 | .0293 | -.078-.016 | 1.717 | *.190* |
| UCLA\_Total | .026 | .0084 | .009-.042 | 9.301 | *.002* |

**DISCUSSION**

The aim of this study was to explore the relationship between emotion dysregulation, loneliness and food addiction. The majority of this sample (79%) reported having difficulties managing their eating behaviours to foods that are typically high in added sugar, fat and/or salt; while 21% of the sample met diagnostic criteria for FA, endorsing at least three symptoms. BMI levels were positively associated with FA. The majority of the sample were within normal BMI rates (47.5%); overweight (21.6%) and obese (25.9%) rates were also present within this cohort. Overall, the model suggests that emotion dysregulation and loneliness have an important role in the development of an addictive behaviour towards hyperpalatable foods. Emotion dysregulation occurs when an individual lacks the skills required to manage emotions in adaptive ways. The positive association between emotion dysregulation and FA suggests that FA may be driven by unsuccessful attempts to regulate emotions, particularly negative affect. Thus, FA may manifest as a maladaptive attempt at emotion regulation [29, 30]. Our findings suggest that difficulty in engaging in goal-directed behaviour, impulsive control difficulties, lack of emotional awareness and limited access to emotion regulation strategies positively predict FA. The overall score of emotion dysregulation, nonacceptance of emotional

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responses and lack of emotional clarity had no influence on FA. The association between loneliness and food addiction [58, 59], and other addictions [52–53, 55] and unhealthy eating [63, 64] is well-documented. This study indicates loneliness to be positively associated with food addiction, as higher levels of loneliness and/or social isolation are related to higher levels of FA symptom count. Therefore, the findings of this research provide further evidence on the etiology of FA which should be taken into serious consideration.

The effect emotion dysregulation has on FA is documented by previous investigations [29, 30]. In contrast to Innamorati et al.’s [29] finding, our sample indicated that they are more likely to present more food addictive behaviour when they identify problems in concentrating and accomplishing tasks while experiencing negative emotions (GOALS). As FA is characterised by problematic and/or compulsive eating behaviour [8, 9], this finding can be understood by research in the area of compulsivity. Specifically, compulsive behaviours including addictions and binge eating disorder (BED) are characterised by deficits in goal- directed behaviour and increased regression to habitual behaviour [78]. For instance, the experience of negative emotions may impact upon the desirability of outcomes (e.g., consumption of highly palatable foods is more motivated by retrospective experienced reward than by the prospective outcome of anticipated risk of weight gain). In addition, negative emotions may involve changes to the contingency between actions and outcomes (e.g., ‘*When I´m upset, I have difficulty concentrating’*; Item 26 from DERS). Both these alterations in the ´goal-directed´ behavioural system by emotional dysregulation may favour the development of the ´bad habit´ to engage in

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consumption of highly palatable food over anticipatory goal-directed behaviour. Compulsive eating can also be understood as a conflict between an internal, biologically derived drive for food which has its basis in survival and an external culturally derived drive for thinness [79] which may contribute to the conflict experienced. Individuals that are unable to regulate negative emotions and have problems concentrating and accomplishing tasks may be at increased risk of FA due to the competing biological preoccupation with food and difficulties with emotional regulation.

The effect impulsiveness has on FA is well documented [30, 58]. The current sample demonstrated a higher FA symptom count when struggling to control their behaviours when upset, which provides further support for the predictive role impulsiveness has on FA under negative affect. Lack of emotional awareness was another factor that may contribute to the development of FA. These data demonstrated that increased inattention to emotional responses resulted in a higher FA symptom count. A systematic review by Kun and Demetrovics [80] indicated that lower levels of emotional intelligence (i.e., lack of emotional awareness) were related to intense smoking, alcohol use and illicit drugs. Moreover, a recent study by Yildiz [81] indicated that limited access to emotion regulation strategies contributes to the development of internet and smartphone addiction. Our sample demonstrated a similar finding with higher FA symptom count to be associated with struggling to regulate emotions after becoming upset. Considering the similarities within the behavioural addiction literature, the findings of our study suggest impulsiveness, lack of emotional awareness and negative affect have similar relationships across different types of behavioural addictions.

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Surprisingly, the overall measure of emotion dysregulation did not predict FA, suggesting that the relationship between emotion dysregulation (overall) and FA could be mediated by other variables, such as binge-eating severity and BMI. This is interesting, as inspection on the relationship between FA and BMI in the current cohort demonstrated a positive association between these variables. Furthermore, nonacceptance of emotional responses (i.e., someone’s tendency toward negative secondary responses to negative emotions, and/or denial of distress) did not predict FA. A possible explanation could be the way nonacceptance of emotional responses is measured by the DERS. Most of the items in the subscale indicate feelings of embarrassment (e.g., ‘*When I’m upset, I become* *embarrassed for feeling that way’*; Item 12) and guilt (e.g., ‘*When I’m upset, I feel guilty for feeling that way’*; Item 25) and not an actual negative affect that may link to theintention to binge for foods high in added sugar, fat and salt. The predictive role of lack of emotional clarity (i.e., identifies the extent to which individuals are unclear about which emotions they are experiencing) on FA was not significant. Considering some of the similarities between FA and problematic and/or compulsive eating behaviour [8, 9], this is in line with previous findings that suggest that binge eaters, for instance, appraised a stressful situation more than healthy controls [82]. Thus, those who engage in overeating might be able to identify a negative emotional state clearly and tend to act accordingly with their coping strategy of eating.

The effect loneliness has on addictive behaviours [51–59] and unhealthy eating [62–64] is well-documented. This study provides further support for the role of loneliness in the development of FA. Our finding is in line with previous research which has found a

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positive association between high levels of loneliness and high levels of food addiction [58, 59]. The positive predictive role of loneliness on FA indicates that FA symptoms are more likely to be present when experiencing loneliness and/or social isolation. Thus, the euphoria experienced when eating highly processed foods that are typically high in added sugar, fat and salt could be a potential cause of FA. The expectation of euphoria that develops over time could function as a reinforcement for continuing and excessive consumption of hyperpalatable foods, which could provide further support to the ‘addictive appetite’ model of binge-eating behaviour [11, 48] and the proposed assessment criteria of FA which are in parallel with the criteria for substance disorders [7].

***Study limitations***

This research is not without limitations. As per YFAS, 21% of the sample met diagnostic criteria for FA, endorsing at least three symptoms, while the majority of the sample (79%) endorsed a persistent desire or repeated, unsuccessful attempts to cut down or control their use of highly processed foods that are typically high in added sugar, fat and/or salt. Therefore, future research should explore individual differences within the YFAS scale (i.e., individuals who meet the diagnostic criteria for FA vs. individuals who demonstrate addictive overeating to foods that are typically high in added sugar, fat and/or salt) in order to provide more detailed information. Data collection relied solely on self-report measures. Although the questionnaires used in the current research have high ecological validity and reliability, Shiffman, Stone and Hufford [10] suggest that global generalisation cannot be assumed, as questionnaires limit the ability to characterise and

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understand behaviour as it occurs in a natural environment. Thus, future investigations should also consider assessing participants in natural settings. The sampling method was exclusively online. This is common in studies of health and health services, as it can increase the sample of potential participants and reach of a diverse cohort [83, 84]. However, a fundamental issue with online survey research has to do with lack of sampling frame [85–87]. Although a sampling frame was established to minimize any errors and to ensure significant representation of population of interest, Wright [87] highlights self-selection bias as a major limitation of online survey research. Specifically, he reports that there is a tendency for some individuals to respond to a survey invitation, while others ignore it, leading to a systematic bias. For instance, females are more likely to participate in eating-related research than males, which is demonstrated in the current research as the majority of the participants were females. Therefore, it is important future investigations adopt a mixed on- and off-line sampling method to ensure a representative sample is in place.

Considering that FA may overlap with common eating psychopathology, such as binge-eating [66, 88], it is important for future investigations to provide further evidence on the clinical implications of the relationship between binge-eating and FA. BMI was positively correlated with FA levels in the current study highlighting the relationship between addictive overeating and obesity. Further longitudinal research is needed to clarify the pathways between addictive overeating and obesity.

**CONCLUSION**

This research provides evidence on the effect emotion dysregulation and loneliness have

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in the development of FA. Multiple traits of emotion dysregulation, including difficulty in engaging in goal-directed behaviour, impulsiveness, emotional awareness and limited access to emotion regulation strategies, and loneliness were positive predictors of FA. Although findings are fruitful, these must be treated with caution and further empirical research is needed to provide insights into the potential role addictive behaviour of food has in overeating phenomena, such as binge-eating. Understanding the relationship between FA and BED would help clarify the extent to which patterns of abnormal eating reflect addictive engagement in these conditions; and provide further support on the critical reflection of the suitability of the term ‘food addiction’ or ‘eating addiction’ [4–6, 8]. Considering the crucial role loneliness plays in the etiology of addictive behaviours, it is important for further research to explore the psychological underpinnings of loneliness on FA. Conceptualising unhealthy eating behaviours and addressing the psychological underpinnings of loneliness within an addiction framework may contribute to the improvement of prevention strategies and the development of effective treatments that would improve people’s quality of life and provide substantial public health benefit [66].

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