

MINDFULNESS AND SUBJECTIVE VITALITY AS MEDIATORS OF THE RELATIONSHIP BETWEEN DEPRESSION, ANXIETY, STRESS AND EMOTIONAL EATING

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INTRODUCTION

Emotional eating

Emotional eating (EE) has been defined as the tendency to eat in response to negative emotions, such as depression, disappointment, and loneliness [1], [2]. Previous studies have found that the tendency to eat emotionally is associated with a higher body mass index (BMI) [3], higher snack consumption [4], and sweet food consumption in adults [5], and with larger portions consumed among the general population [6]. A recent study that looked at how common EE is among people seeking obesity treatment found that EE was reported by 58% of participants [7]. The tendency to eat emotionally is prevalent in the adult population and, over time, is associated with eating disorders [8] - [10] and weight gain [11]. In addition to these factors, emotional eating has been associated with psychological disorders and depressive symptoms in adults [5], [12], [13] and professional burnout in women [14]. Evidence and current theory suggest that emotional eating results from attempts to manage anxiety, depression and stress and is considered a major contributor to obesity [13].

Predictors of emotional eating: depression, anxiety and stress

Perceived stress, depression and anxiety have been studied in relation to emotional eating, this relationship being confirmed repeatedly, as shown by a recent systematic review [15]. Previous studies have linked depression both directly to the tendency to eat emotionally and indirectly, through "difficulty identifying emotions" and "impulse control" [16]. An explanation for the relationship identified between depression and the tendency to eat emotionally is provided by theories of emotion regulation, eating emotionally has the effect of reducing awareness of the distress felt, either by blocking or dissociation [17]. Another possible explanation for this relationship is that emotional eating occurs as a result of reduced awareness of a distress felt [8] Perceived stress was also related to emotional eating [18]

Subjective vitality, mindfulness and emotion regulation as mediators of the relationship between depression, anxiety and stress and emotional eating

Current scientific evidence shows that emotional eating is a risk factor for obesity as well as for the development of eating disorders. It is also well established that depression, anxiety and stress are predictors for emotional eating. Research is now moving towards understanding the mediating factors of this relationship in order to develop effective intervention programs for the management of emotional eating. The aim of this study is to explore the relationship between depression, anxiety and stress and emotional eating and to test the potential for mediating subjective vitality, mindfulness and emotion regulation strategies. This is a cross-sectional study, conducted on an opportunistic sample of 2632 people; data collection was via a "Google forms". The questionnaire included a section on demographics (sex, age, education, occupation, marital status, monthly income), and measurement scales for both the dependent variable (emotional eating) and the independent variables (stress, depression, anxiety, subjective vitality, mindfulness, emotion regulation). The results indicate that emotional eating is a very common behavior in the study population, with 43.1% of participants having this tendency. Depression, anxiety, and stress correlate positively with emotion eating, while subjective vitality, mindfulness, and emotion regulation correlate negatively. Subjective vitality mediates both the impact of depression and anxiety on eating emotionally and mindfulness only that of depression. At the clinical level, this study indicates the need to develop programs focused on detecting a potential underlying depression when emotional eating is present as well as the development of programs based on increasing subjective vitality and training mindfulness to reduce emotional eating.

Keywords: emotional eating, depression, anxiety, emotional stress.

Many researchers suggest that dysfunctional diets (eg, restricting food, bingeing, or purging) may be inappropriate strategies to regulate emotional distress [18], [19]. Recent studies show that people with eating disorders have a low quality of life in the psychosocial dimension and especially in the areas of vitality, social functioning and mental health [20]. Another study indicates that people who have low scores for emotional eating tend to have higher subjective vitality, experience more positive emotions, and derive more satisfaction from their meals while people with high scores in emotional eating have lower levels of subjective vitality, experience less positive emotions, have less adaptive coping strategies, and have more dissatisfaction with their meals. [21]

Mindfulness has also been linked to emotional eating and depressive, anxious or stressful experiences. Predictably, depression, anxiety, and psychological stress were positively associated with emotional eating, while mindfulness demonstrated an inverse relationship. The results of this study support the use of mindfulness-based interventions to treat emotional eating in people with anxiety, stress, and lower levels of depression. Previous studies have examined the potential for mediating the relationship between anxiety, depression, stress, and emotional eating in isolation for subjective vitality, mindfulness, and emotion regulation strategies, and have often focused on certain categories of participants (e.g., individuals suffering from obesity, women, etc.). Our study takes into account all these factors and does not limit participation based on demographic variables.

AIM AND HYPOTHESES

Current scientific evidence shows that emotional eating is a risk factor for obesity and the development of eating disorders. It is also well established that depression, anxiety and stress are predictors of the tendency to eat emotionally. Research is now moving towards understanding the mediating factors of this relationship in order to substantiate effective intervention programs for the management of emotional eating. To our knowledge, this is the first study conducted on the Romanian population that tries to highlight the role that subjective vitality, mindfulness and emotion regulation play in mediating the relationship between depression, anxiety, stress and emotional eating. We therefore aimed to explore the relationship between depression, anxiety, stress and emotional eating as well as to test whether subjective vitality, mindfulness, and emotion regulation mediate this relationship. In order to achieve this aim, six specific hypotheses have been formulated as follows: (1) Self-reported depression, anxiety, and stress are positively correlated with the tendency to eat emotionally; (2) people who tend to eat emotionally have higher depression, anxiety and stress scores compared with those who do not; (3) people with high level of depression, anxiety and self-reported stress will also tend to have higher rates of emotional eating compared to people who have a low level; (4) subjective vitality, mindfulness and emotion regulation through cognitive re-evaluation correlate negatively with emotional eating and emotion regulation by suppressing emotion correlates positively with emotional eating; (5) depression, anxiety and stress correlate negatively with subjective vitality, mindfulness and emotion regulation through cognitive re-evaluation and positively with emotion regulation through suppression of emotions; (6) the relationship between depression, anxiety and stress and the tendency to eat emotionally is mediated by subjective vitality, mindfulness and emotion regulation.

RESEARCH METHODOLOGY

This research is a cross-sectional study in which data collection was done through an online questionnaire distributed via "Google forms". The questionnaire was distributed in social media channels or by direct mail. An opportunistic sample of 2632 participants have completed the online questionnaire between May 6 and November 29, 2015. The questionnaire includes a section of demographic data (gender, age, education, occupation, marital status, monthly income), and measurement scales for both the dependent variable (emotional eating) and the independent variables (stress, depression, anxiety, subjective vitality, mindfulness, emotion regulation). The instruments used to measure the dependent and the independent variables are presented in detail as follows.

Emotional Eating Scale (EES)

The Emotional Eating Scale (EES) is a 25-item self-report questionnaire that assesses an individual's need to eat in response to specific emotional stimulus, such as sadness, anger, guilt [22]. A revised version has been developed and tested to include a separate factor for boredom [23]. For each item, the desire to eat is rated on a 5-point Likert

scale, ranging from 0 with no desire to 4 with an overwhelming desire to eat. The scores of all items are summed to form a total score, where a higher score indicates a higher severity of EE. As there are no diagnostic criteria for EE, we chose a pre-specified threshold of the EES score ≥ 24 to define EE, which indicates, on average, at least a small desire to eat in response to negative emotions. EES has previously been used in studies that have tested mindfulness-based interventions in patients with bariatric surgery [24] or to support weight management in women [25]. In previous studies, EES has shown good internal consistency ($\alpha = .81$). On the population we investigated, Cronbach's Alpha coefficient was high ($\alpha = .96$).

Depression, Anxiety, Stress Scale (DASS-21)

DASS 21 is a set of three self-reported scales designed to measure depression, anxiety and stress. Each of the three DASS-21 scales contains 7 items. Respondents rate for each item how much in the last week each statement applies to him/her, using a scale from 0 (did not apply to me) to 3 (it applied to me very much or almost all the time). The score of each scale is obtained by summing up the answers. High scores are indicative of high levels of anxiety, depression, or stress. The depression scale assesses dysphoria, hopelessness, devaluation of life, self-depreciation, lack of interest / involvement, anhedonia and inertia. The anxiety scale assesses autonomic arousal, skeletal muscle effects, situational anxiety, and subjective experience of anxiety. The stress scale is sensitive to chronic nonspecific stress levels. Assess relaxation difficulties, nervous arousal and agitation, irritability/over-reactivity and impatience. Scores for depression, anxiety and stress are calculated by summing the scores for the relevant items. DASS-21 is based on a dimensional conception and not on a categorical conception of psychological disorder. DASS-21, therefore, has no direct implications on the allocation of patients to discrete diagnostic categories, postulated in classification systems such as DSM and ICD. DASS-21 proved to have a good internal consistency, on the population we investigated the Cronbach's Alpha coefficient being a high one ($\alpha = .93$).

Subjective Vitality Scale (SVS)

Subjective Vitality (SV) was defined and measured by Ryan and Frederick as the subjective experience of being full of energy and life. Those with a high level of subjective vitality report feeling alert, energized and vital [26]. Subjective vitality can be understood as the experience of having energy available or in the regulatory control of the individual. Subjective vitality is the state of feeling alive, of having positive emotions, is considered an aspect of emotional and physical well-being [27] and is derived from an internal source [28]. SVS initially contains seven items measured on a 7-point Likert scale, from 1 (not true) to 7 (very true), with scores ranging from 7–49. Higher measurement scores indicate a higher SV. SVS demonstrated good internal consistency both in previous studies ($\alpha = .91$) [29] and in our study ($\alpha = .82$).

Mindfulness Attention Scale (MAS)

The mindfulness awareness (MAAS) scale assesses individual differences in the frequency of mindfulness states experienced over time. MAAS uses 15 items that participants rate on a scale of 1 (almost always) to 6 (almost never). Scoring involves calculating the average performance of the 15 items, with higher scores indicating more attention. In previous studies, MAAS indicated a good internal consistency, $\alpha = .89$ [30]. The Cronbach's Alpha coefficient on the population investigated in the present study was also high ($\alpha = .90$).

Emotion regulation Questionnaire (CRE10)

The Emotion regulation Questionnaire (CRE10) was developed by Gross and John [31] to assess individual differences in the use of two emotion regulation strategies: cognitive re-evaluation (eg, I control my emotions by changing the way I think about the situation) and expressive suppression (eg, I control my emotions by not expressing them). The questionnaire has 10 items rated on a Likert scale from 1 (strongly disagree) to 7 (strongly agree). Scoring is done by calculating the averages for each of the two scales. CRE10 indicated a good internal consistency in the present study, for which we obtained a Cronbach's Alpha coefficient of $\alpha = .85$.

RESULTS

Participants

A total of 2615 people participated in this study, 66.7% women, and 33.3% men. Among the participants, 83.1% live in urban areas, and 16.9% in rural areas. The mean age of the participants is 35.42 years ($SD=11.58$), and in terms of marital status, 45.2% say they are married, 41.6% single, 9.1% divorced, and the rest widowed.

Among the participants, 32.7% reported that the last form of education graduated is high school, 39% college, 18.5% graduated a master's program, and 1.7% completed doctoral studies; 4.6% graduated from general school, and 3.5% other forms of education. In terms of employment status, the majority of participants (62%) were employed at the time of data collection, 15.4% were still pupils or students, 5.2% said they were entrepreneurs, 3.4% retired, 2.8% unemployed, and 10.6% were in another category, otherwise not specified.

59.8% of participants have an income less than or equal to 2000 RON per month, with the remaining 40.2% falling into different income categories; 7.9% of them said they have a monthly income above 5000 RON. The frequency distribution among detailed categories of revenue is included in Table 1 below.

Emotional eating

The emotions for which the average exceeded 1, indicating a small desire to eat, were: "bored," "exhausted," "stimulated", and "excited". On the opposite side, the emotions that induced a least desire to eat (with averages between 0,80 and 0,82) are: "indisposed", "powerless", "jealous", "disturbed". The means and standard devia-

Table 1. The distribution of participants by monthly income category

Categories of income	N	%	Cumulative %
Less than 1000 RON per month	572	21.9	21.9
Between 1000 and 1500 RON per month	530	20.3	42.1
Between 1000 and 2000 RON per month	463	17.7	59.8
Between 2000 and 2500 RON per month	312	11.9	71.8
Between 2500 and 3000 RON per month	193	7.4	79.1
Between 3000 and 3500 RON per month	125	4.8	83.9
Between 3500 and 4000 RON per month	125	4.8	88.7
Between 4500 and 5000 RON per month	90	3.4	92.1
More than 5000 RON per month	206	7.9	100.0
Total	2616	100.0	

Table 2. Averages and Standard deviations for the emotions that generate the desire to eat

	Average	Standard deviation
Bored	1.37	1.23
Exhausted	1.10	1.14
Stimulated	1.08	1.16
Excited	1.05	1.15
Impatient	.97	1.11
Nervous	.94	1.15
Restless	.93	1.07
Frustrated	.92	1.09
Insecure	.91	1.01
Inefficient	.90	1.04
Sad	.90	1.08
Upset	.90	1.11
Irritated	.89	1.07
Discouraged	.87	1.03
Unruly	.87	1.06
Angry	.87	1.12
Lonely	.86	1.02
Depressed	.84	1.03
Confused	.84	.99
Resentful	.83	1.02
Disturbed	.82	1.030
Jealous	.81	1.07
Powerless	.81	1.05
Indisposed	.80	1.02

tions for all emotions included in the analysis are presented in Table 2.

Regarding the frequency of emotional eating behaviour, 43.1% of the participants reported this behaviour, obtaining an average score equal to or higher than 24 (Table 3).



Table 3. Frequency of emotional eating behaviour in the study population

Scale for assessing emotional eating behaviour	N	%
Score < 24	1489	56.9
Score equal or > 24	1127	43.1
Total	2616	100.0

Hypothesis testing**Hypothesis 1 - Self-reported depression, anxiety, and stress are positively correlated with the tendency to eat emotionally**

The Pearson correlation coefficient was calculated in order to test this hypothesis. The results indicate a significant positive association between emotional eating and depression ($r(2616)=.29$, $p=.000$), anxiety ($r(2616)=.30$, $p=.000$) and stress ($r(2616)=.29$, $p=.000$) (Table 4). To explore the nature of this association, at a later stage the differences in averages were calculated for both depression, anxiety and stress depending on emotional eating but also for emotional eating by different levels of severity of self-reported depression, anxiety and stress.

Table 4. Pearson correlation coefficients for the association between the scores obtained on the emotional eating scale and the DASS21 scales (depression, anxiety, stress).

	1	2	3	4
Emotional eating	1	-	-	-
Stress (DASS)	.29**	1	-	-
Anxiety (DASS)	.30**	.74**	1	-
Depression (DASS)	.32**	.76**	.74**	1

Note ** The correlation is significant at the 0.01 threshold

Hypothesis 2 - People who tend to eat emotionally have higher depression, anxiety and stress scores compared with those who do not

To test this hypothesis, we used “t test” for independent samples. We obtained significant differences for all three variables tested: self-reported depression ($t(2215)=15.52$, $p=.000$), self-reported anxiety ($t(2339)=14.20$, $p=.000$), self-reported stress ($t(2152)=12.91$, $p=.000$).

Hypothesis 3 - People with high level of depression, anxiety and self-reported stress will also tend to have higher rates of emotional eating compared to people who have a low level.

Differences among participants in terms emotional eating were calculated for the five categories of self-reported severity of depression, anxiety, and stress (i.e., normal, mild, moderate, severe, and extremely severe). The unifactorial analysis of variance revealed a significant difference between these averages, as follows:

For depression, $F(4, 2611)=76.64$; $p=.000$. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the categories “normal” ($M=16.42$; $SD=16.86$), “mild” ($M=22.65$; $SD=17.15$), and “moderate” ($M=27.02$; $SD=17.58$) differ significantly for all possible comparison variants, while for the “severe” ($M=32.02$; $SD=20.03$) and “extremely severe” ($M=33.77$; $SD=24.86$) categories, significant differences were observed only in relation to the other categories but not between them.

For anxiety, $F(4, 2611)=65.54$; $p=.000$. Post-hoc comparisons using the Tukey HSD test indicated the existence of three homogeneous subsets between which significant differences can be observed. The first subset consists of the categories “normal” ($M=16.26$; $SD=16.85$), and “light” ($M=19.08$; $SD=15.96$); the second subset includes only the “moderate” category ($M=22.67$; $SD=18.02$), and the third subset includes the “severe” ($M=29.25$; $SD=19.54$), and “extremely severe” categories ($M=30.88$; $SD=20.65$). There are no significant differences between the categories in each subset.

For stress, $F(4, 2611)=63.32$; $p=.000$. Post-hoc comparisons using the Tukey HSD test indicated significant differences between “normal” ($M=17.52$; $SD=17.00$), and “mild” ($M=24.97$; $SD=18.45$), and “moderate” ($M=29.05$; $SD=18.23$) with all other categories; no significant differences were observed between the “severe” ($M=31.78$; $SD=25.16$), and “extremely severe” ($M=31.62$; $SD=25.16$) categories.

Taken together, these results suggest that higher levels of depression, anxiety, and stress can lead to the appearance or increase of the emotional eating behaviors.

The graphical representation of these relationships is included below, as Figure 1.

Hypothesis 4 - Subjective vitality, mindfulness and emotion regulation through cognitive re-evaluation correlate negatively with emotional eating and emotion regulation by suppressing emotion correlates positively with emotional eating.

To test this hypothesis was calculated the Pearson correlation coefficient. The results indicate significant negative associations of low intensity between emotional eating and subjective vitality ($r(2616)=-.13$, $p=.000$), mindfulness ($r(2616)=-.13$, $p=.000$), and the cognitive reappraisal scale of the emotional suppression questionnaire, as follows: ($r(2616)=-.06$, $p=.000$) (see Table 5).

The observed relationship between regulation by emotions suppression and emotional eating is indeed of a positive nature, but this association is not statistically significant.

is significant at the 0.01 threshold

Hypothesis 5 - Depression, anxiety and stress correlate negatively with subjective vitality, mindfulness and emotion regulation through cognitive re-evaluation and positively with emotion regulation through suppression of emotions

To test this hypothesis, the Pearson correlation coefficient was calculated. Negative associations of

low intensity being observed between subjective vitality and stress ($r(2616)=-.28, p=.000$) and between subjective vitality and anxiety, ($r(2616)=-.29, p=.000$). Between subjective vitality and depression, the results of the Pearson correlation indicate a negative association of moderate intensity, ($r(2616)=-.41, p=.000$).

For mindfulness, the association with stress is a negative one of low intensity ($r(2616)=-.28, p=.000$), as is the one with anxiety ($r(2616)=-.29, p=.000$). Between mindfulness and depression, the results of the Pearson correlation indicate a negative association of moderate intensity, ($r(2616)=-.30, p=.000$). Low-intensity negative associations were also observed between emotion regulation through cognitive reappraisal, and stress ($r(2616)=-.15, p=.000$), anxiety, ($r(2616)=-.18, p=.000$), and depression ($r(2616)=-.22, p=.000$). Between the emotion regulation by emotions suppression and stress, the association is not significant ($r(2616)=-.01, p=.568$), the association with anxiety is a negative one, of low intensity ($r(2616)=-.05, p=.010$), as well as for depression ($r(2616)=-.08, p=.000$) (Table 6).

Hypothesis 6 - The relationship between depression, anxiety and stress and the tendency to eat emotionally is mediated by subjective vitality, mindfulness and emotion regulation.

The predictive potential of the variables studied in relation with emotional eating was tested by multiple regression analysis. The first model tested included as predictors all the variables studied: subjective vitality, mindfulness, emotion regulation by emotions suppression, emotion reg-

Table 5. Pearson correlation coefficients for the association between scores on the emotional eating scale and subjective vitality, mindfulness, and emotion regulation scales (cognitive reappraisal and emotional suppression)

	1	2	3	4	5
Tendency to emotional eating (SME)	1	-	-	-	-
Subjective vitality (SVS)	-.13**	1	-	-	-
Mindfulness (CAM)	-.13**	.49**	1	-	-
Cognitive reappraisal (CRE10)	-.06**	.46**	.35**	1	-
Emotional suppression (CRE10)	.01	.12**	.09**	.33**	1

Note ** The correlation is significant at the 0.01 threshold

ulation by cognitive reappraisal, stress, anxiety, and depression. This model is statistically significant, ($R^2=.11,6 F(7,2608)=49.03, p<.000$) and only three predictors are significant at $p<.05$, respectively stress, anxiety, and depression. After removing the subjective vitality of mindfulness and emotion regulation, the final regression model indicates that three predictors explain 11.5% of the variance ($R^2=.11,5 F(3,2612)=113.42, p<.000$). The model highlighted that depression is a significant predictor of emotional eating ($\beta = .19, p<.000$), as well as anxiety ($\beta = .09, p<.001$), and stress ($\beta = .07, p<.019$). The predictive potential of the other factors is low (approximately 0.1%), although most correlations are significant, and regression models that consider subjective vitality and mindfulness are statistically significant. Univariate patterns with the three factors presented above indicate that depression has the highest predictive value ($R^2=.10,6 F(1,2614)=310.42, p<.000$), followed by anxiety ($R^2=.09, F(1,2614)=259.08, p<.000$), and stress ($R^2=.08, F(1,2614)=254.10, p<.000$).

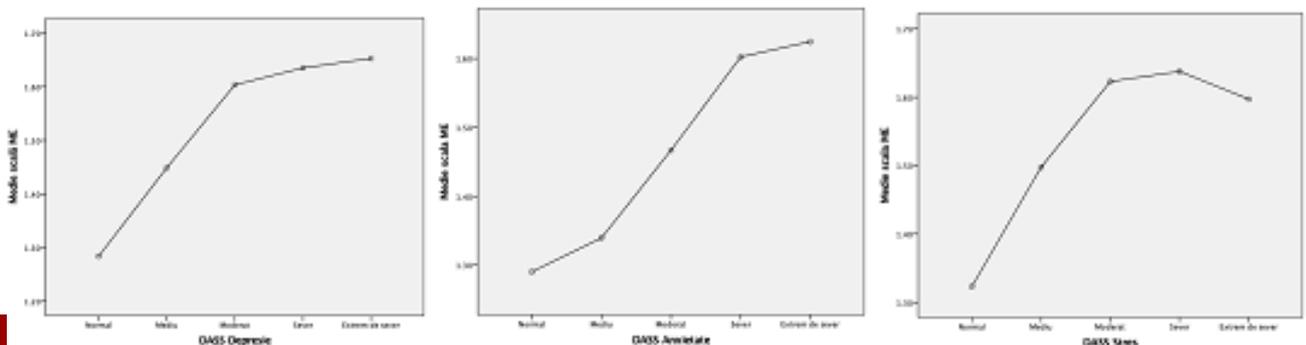
For each of the three predictors (depression, anxiety, stress), we tested the moderating effect of subjective vitality, mindfulness and emotion regulation. For this purpose, both the scores for depression, anxiety and stress and the scores for subjective vitality, mindfulness and emotion

Table 6. Pearson correlation coefficients for the association between scores obtained for depression, anxiety, stress and subjective vitality, mindfulness, and emotion regulation scales (cognitive reappraisal and emotional suppression)

	1	2	3	4	5	6	7
Subjective Vitality (SVS)	1	-	-	-	-	-	-
Mindfulness (CAM)	.49**	1	-	-	-	-	-
Cognitive reapp. (CRE10)	.46**	.35**	1	-	-	-	-
Emotional supp. (CRE10)	.12**	.09**	.33**	1	-	-	-
Stress (DASS)	-.29**	-.28**	-.16**	.01	1	-	-
Anxiety (DASS)	-.29**	-.30**	-.18**	.05*	.75**	1	-
Depression (DASS)	-.41**	-.30**	-.22**	.08**	.77**	.75**	1

Note: ** The correlation is significant at the 0.01 threshold; * The correlation is significant at the 0.05 threshold

Figure 1. Graphical representations of differences in the average for tendency of emotional eating according to the severity category of self-reported depression, anxiety and stress



regulation (moderators) were standardized in z scores, generating the interaction variable by multiplying them. 12 hierarchical regressions were performed for depression and: 1) mindfulness, 2) subjective vitality, 3) emotion regulation by cognitive reappraisal and 4) emotion regulation by emotional suppression in block 1, and interaction variables in block 2. The same thing was done for anxiety and: 5) mindfulness, 6) subjective vitality, 7) emotion regulation by cognitive reappraisal and 8) emotion regulation by emotional suppression. Also, for stress and: 9) mindfulness, 10) subjective vitality, 11) emotion regulation by cognitive reappraisal, and 12) emotion regulation by emotional suppression. We have obtained significant results for models 2, 3, 6, and we include the results below.

For model 2, the R^2 change value for the interaction model was 0.002, statistically significant [$F(1,2612) = 5.37$; $p = 0.020$]. This result indicates that subjective vitality reduces the impact of depression on emotional eating.

For model 3, the R^2 change value for the interaction model was 0.001, statistically significant [$F(1,2612) = 4.03$; $p = 0.045$]. This result indicates that mindfulness also diminishes the impact of depression on emotional eating.

For model 6, the R^2 change value for the interaction model was 0.003, statistically significant [$F(1,2612) = 8.83$; $p = 0.003$]. This result indicates that subjective vitality also diminishes the impact of anxiety on emotional eating.

CONCLUSIONS

Depression, anxiety and stress are factors that increase the risk for emotional eating behaviour. In unifactorial regression models, depression is the strongest predictor, followed by anxiety and stress.

Mindfulness, subjective vitality and the strategy of emotion regulation by cognitive reappraisal correlate negatively with emotional eating, having the potential to reduce the frequency of emotional eating if interventions are developed around them. Of these, mindfulness has the highest correlation coefficient.

When testing the predictive potential of these variables, only mindfulness and subjective vitality are significant predictors in the absence of depression, anxiety, and stress, but their predictive power is insignificant (0.1% cumulative).

Subjective vitality mediates both the impact of depression and anxiety on emotional eating and mindfulness only that of depression.

At the clinical level, this study indicates the need for programs focused on detecting the underlying depression when emotional eating levels are high, as well as the development of programs based on increasing subjective vitality, and training mindfulness to reduce emotional eating.

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