Iran J Psychiatry 2025; 20: 3: 304-320

Original Article *https://doi.org/10.18502/ijps.v20i3.19035*

The Role of Emotional Schemas in Binge Eating and Bedtime Procrastination

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Abstract

Objective: Given the increasing prevalence of binge eating disorder (BED) and bedtime procrastination (BP) among university students, as well as the notable absence of validated Arabic instruments to assess these behaviors, this study aimed to investigate the role of emotional schemas in BED and BP among university students. By examining these emotional schemas, the study sought to shed light on a potential shared underlying mechanism contributing to both BED and BP, and to adapt and validate the Bedtime Procrastination Scale (BPS) for Arabic-speaking populations.
Method: Three samples of Iraqi university students were recruited. The first sample (n = 835) was used for the validation of the Arabic version of the BPS. The second sample (n = 58) was utilized for convergent validity testing, and the third sample (n = 490) was examined for exploring the associations between emotional schemas, BED, and BP.
Results: Analyses revealed that maladaptive emotional schemas—particularly devalued, non-acceptance of feelings, incomprehensibility, numbness, blame, and low consensus—accounted for 18.2% of the variance in BED. Additionally, important findings emerged for BP, where incomprehensibility, non-acceptance of feelings and simplistic view of emotion accounted for 5.8% of the variance. Additionally, the Arabic adaptation of the BPS demonstrated robust psychometric properties and confirmed a two-factor structure consistent with previous cultural adaptations.
Conclusion: These findings underscore the necessity of addressing emotional schemas in therapeutic interventions to reduce BED and BP. Furthermore, the validated Arabic BPS offers a vital tool for future research and assessment in Arabic-speaking contexts.

Key words: *Binge Eating Disorder; Emotions; Factor Analysis; Procrastination; Schemas*

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Article Information:
Received Date: 2025/01/05, Revised Date: 2025/03/01, Accepted Date: 2025/04/20

According to the World Health Organization, young people are one of the groups most affected by eating disorders such as anorexia nervosa, bulimia nervosa, and binge eating disorder (BED) (1). Cases of eating disorders peak in late adolescence, with most developing between the ages of 17 and 22, a period that closely coincides with the transition to college (2). This transition to university life, characterized by reduced parental control as well as academic pressures, mental health challenges, financial burdens, and social adjustments (3-6), creates a high-risk environment for the onset and persistence of eating disorders.

Furthermore, BED is influenced by the dominant cultural context (7). Iraqi culture, in turn, encourages excessive food consumption and regards it as an indicator of the many achievements of an individual, particularly men. Although this hypothesis is not supported by a local study, it is indirectly supported by a review study (8), which concluded that individuals in Kuwait a neighboring country with a culture very similar to Iraq's are more likely to develop BED compared to other Arab countries. Additionally, a study by Schulte (2016) in the UAE showed that one-third of the student participants exhibited moderate to severe BED (9).

BED, recently included in the DSM-5, is diagnosed based on the presence of recurrent episodes of loss of control over eating large quantities of food, accompanied by significant psychological distress and the absence of compensatory behaviors (10). It is defined as "a severe, life-threatening eating disorder characterized by recurrent, periodic binge eating episodes accompanied by negative psychological and social issues, but without subsequent vomiting" (11). The disorder is associated with long-term physical and psychological health symptoms, such as suicide attempts, substance use disorders, and borderline personality disorder and obesity (10). Obesity, in turn, increases the risk of diabetes, heart disease, and hypertension (10, 12).

The impact of BED extends beyond health-related outcomes to include academic performance and social functioning. For example, concerns about weight affect academic performance in 17.4% of females and 10.4% of males (6); individuals with BED are less likely to graduate, and the disorder is associated with lower annual academic progress, higher course failure rates (1, 13), and strained interpersonal correlations that can lead to increased absenteeism and job loss (1). Prevalence studies among student populations report BED rates ranging from 0% to 12.9% (14). While some studies suggest differences between males and females, the majority indicating comparable prevalence between males and females; however, the psychological harms appear more pronounced among females (14, 15).

Parallel to BED, bedtime procrastination (BP) has emerged as a significant behavioral concern among university students. BP is defined as "not going to bed at the intended time, despite the absence of external circumstances preventing the person from doing so" (15). This behavior leads to reduced sleep duration, which is associated with risks including heart disease, diabetes, weight gain, decreased immune function, and increased mortality, as well as cognitive decline, poor academic performance, mental stress, and lower levels of optimism (16-18).

Given the substantial impact of BP on overall well-being, it is essential to have a reliable and culturally appropriate tool to assess this behavior. To address this need, the present study involves the development of an Arabic version of the Bedtime Procrastination Scale (BPS). The BPS has been translated into several languages, with previous studies revealing different findings regarding its factorial structure. For example, when first introduced by Kroese *et al*. (2014), the scale exhibited a single-factor structure (15), which was subsequently confirmed in Turkish (19) and Chinese (20) versions. Conversely, some later studies, such as Japanese (21) and Persian (22) versions, have indicated that the scale consists of a two-factor structure. Accordingly, it is expected that the Arabic version will reflect one of these structures after rigorous testing and validation in the Middle East context.

Recent research suggests that both BED and BP may be influenced by difficulties in emotional regulation. Emotion regulation theory posits that individuals may engage in maladaptive behaviors such as binge eating or delaying sleep as a way to manage negative emotional states (23). Clinical observations indicate that some individuals experience heightened anxiety and stress prior to binge episodes, with these feelings subsiding during the episode (24), and similar associations have been found between anxiety and BP (17, 25). Both the emotion regulation difficulties and anxiety correlated with BED and BP are influenced by (maladaptive) emotional schemas.

Emotional schemas, defined as "the cognitive structures that guide how individuals interpret, process, and respond to their emotions," (26) include 14 factors. These encompass validation (understanding and validating emotions), comprehensibility (making sense of emotions), guilt/shame (feeling guilt or shame about emotions), simplistic view (difficulty tolerating mixed feelings), control (perceiving emotions as out of control), values (emotions are linked to higher values), numbness (feeling as if one has no feelings), rationality (emphasizing rationality rather than emotion), duration (emotions lasting a long time), consensus (perceiving emotions as commonly shared), rumination (dwelling on negative feelings), acceptance (accepting emotional experiences), expression (expressing feelings openly), and blame (attributing one’s emotional states to others) (27). Leahy’s theoretical model posits that maladaptive emotional schemas underlie a variety of psychological disorders, including anxiety (28), obsessive-compulsive disorder (29), depression (30), and somatization (31). However, the specific contribution of emotional schemas

to BED remains underexplored, despite being affected by emotional aspects. Studies have indicated that individuals with a low level of active emotion regulation strategies may use BP as a way to cope with negative emotions (32). Furthermore, reducing anxiety levels can inhibit BP (33). Depression has also been found to contribute to BP (34), particularly among adolescents (35). BP is also correlated with difficulties in emotion regulation, mood and temperament issues, and suicidal behavior (16).

In summary, the literature suggests that maladaptive emotional schemas may serve as a unifying mechanism contributing to both BED and BP by fostering anxiety, depression, and ineffective emotional management. Based on this premise, the current study posits the following hypotheses:

Hypothesis 1: Maladaptive emotional schemas positively contribute to the severity of BED among university students.

Hypothesis 2: Maladaptive emotional schemas positively contribute to the severity of BP among university students.

***Hypothesis 3*:** The Arabic adaptation of the BPS will demonstrate sound psychometric properties, consistent with previous adaptations in other cultural contexts.

By integrating an examination of BED and BP within an emotional regulation framework, this study fills a critical research gap. It clarifies how maladaptive emotional schemas contribute to these maladaptive behaviors and provides a validated tool for assessing BP in Arabic-speaking contexts.

Materials and Methods

Sample

The study included three samples of university students, selected using a random convenience sampling method. The first sample consisted of 835 participants and was used to validate the exploratory and confirmatory factor analysis of the Bedtime Procrastination Scale. The second sample included 58 participants and was used to verify the convergent validity of the Bedtime Procrastination Scale. The third sample consisted of 490 participants and was used to explore the role of emotional schemas in both BED and BP.

The sample sizes were determined based on the criteria proposed by Nunnally & Bernstein (1995), which recommend including 6-10 participants for each item on the scale (36). Three separate samples were used to avoid overloading participants with multiple questionnaires at the same time, which could lead to fatigue. The demographic characteristics of the samples varied (see Table 1), and this demographic diversity helps ensure greater generalizability of the results.

Table 1. Demographic Characteristics of Three Iraqi University-Student Samples and Their Mean, SD Scores on the Leahy Emotional Schema Scale-II, Binge-Eating Scale, and Bedtime Procrastination Scale.

Dimension	N = 490				N = 835	N = 58
	Frequencies	Mean \SD (BPS)	Mean \SD (BES)	Mean \SD (LESS-II)	Frequencies	Frequencies
Sex						
Male	132 (27%)	21.64 (5.18)	26.70 (8.02)	98.43 (13.45)	352 (42%)	20 (34%)
Female	358 (73%)	22.38 (5.81)	26.37 (7.56)	100.97 (13.95)	483 (58%)	38 (66%)
File of study						
Scientific	169 (34%)	21.61 (5.43)	26.53 (7.91)	98.76 (13.52)	191 (77%)	50 (86%)
Humanistic	321 (66%)	23.27 (5.92)	26.31 (7.25)	103.19 (14.05)	644 (23%)	8 (13%)
Academic stage						
First stage	7 (1%)	19.57 (2.22)	16.85 (2.26)	89.57 (14.58)	133 (16%)	
Second stage	233 (48%)	22.20 (5.47)	26.37 (7.73)	100.36 (12.55)	337 (40%)	
Third stage	51 (10%)	21.47 (5.40)	26.60 (7.72)	99.17 (15.81)	112 (13%)	1 (2%)
Fourth stage	155 (32%)	22.72 (5.96)	26.24 (7.23)	101.70 (14.26)	120 (14%)	56 (96)
Postgraduate studies	44 (9%)	21.45 (6.07)	29.02 (8.29)	97.95 (15.87)	113 (16%)	1 (2%)
Marital status						
Single	341 (70%)	21.82 (5.53)	26.07 (7.60)	100.43 (14.03)	430 (51%)	37 (64%)
Married	38 (8%)	23.21 (5.78)	27.55 (7.74)	99.34 (11.86)	114 (14%)	16 (28)

In relationship	81 (17%)	22.90 (5.84)	27.58 (8.15)	97.16 (13.45)	244 (29%)	4 (7%)
Complicated	30 (6%)	23.13 (6.17)	26.50 (7.15)	108.33 (12.38)	47 (6%)	1 (2%)
Housing						
With family	439 (90%)	22.13 (5.77)	26.43 (7.61)	100.37 (13.92)	587 (70%)	20 (34%)
Away from family	51 (10%)	22.66 (4.53)	26.66 (8.29)	99.58 (13.35)	248 (30%)	38 (65%)
Age						
18- 30	448 (92%)	22.20 (5.57)	26.30 (7.57)	100.73 (13.53)	678 (81%)	37 (64%)
31-43	36 (7%)	22.38 (6.03)	28.16 (8.71)	95.13 (15.83)	148 (18%)	14 (24%)
44-54	6 (1%)	19.33 (9.07)	28.00 (9.14)	97.83 (20.77)	9 (1)	7 (12)

LESS-II = Leahy Emotional Schema Scale-II, BES = Binge-Eating Scale, BPS = Bedtime Procrastination Scale. Scientific = Includes specializations within humanities colleges such as Law, Literature, and Education. Humanistic = Includes specializations within humanities colleges such as Law, Literature, and Education.

Procedures

An online questionnaire was developed and exclusively administered through Google Forms, ensuring that participants could only submit their responses once and were required to complete all items before submission. Prior to participation, students provided informed consent, affirming their voluntary involvement in the study. To enhance the accuracy and reliability of the results, data collection targeted three distinct samples of university students from multiple governorates across Iraq. Participants were recruited from the following institutions:

- University of Anbar (Anbar).
- University of Mosul (Mosul).
- Tikrit University (Saladin).
- Al-Qadisiyah University (Qadisiyah).
- Wasit University (Wasit).
- Baghdad University (Baghdad).
- Al-Mustansiriya University (Baghdad).
- Dijlah College (Baghdad).

For the first sample (835 participants), only the BPS was sent, focusing on this behavioral pattern in more detail for exploratory and confirmatory factor analysis. The second sample (58 participants) received the BPS, the Irrational Procrastination Scale (IPS), and the Brief Self-Control Scale to extract correlations between these measures and obtain the convergent validity of the BPS. Finally, the third sample (490 participants) was provided with the Emotional Schema Scale, the Binge Eating Scale (BES), and the BPS to explore the correlations between these constructs and the role of emotional schemas in them.

Recruitment took place over two weeks, targeting current university students. To maintain sample integrity, access to the questionnaire was restricted to individuals using academic email accounts. Confidentiality and privacy were strictly maintained, and all data collection procedures adhered to approved ethical guidelines to protect participants and ensure the integrity of the study.

Measurements

Leahy Emotional Schema Scale II (LESS-II)

The Leahy Emotional Schema Scale-II (LESS-II) developed by Leahy (26, 27) is a self-report scale consisting of 28 items evaluated on a six-point Likert scale, ranging from 1 (Completely untrue for me) to 6 (Completely true for me). The scale is widely used in clinical and research settings to measure maladaptive emotional schemas. The scale covers 14 emotional schema factors, with each factor represented by two items. Items 4, 6, 14, 15, 19, 24, 25, and 26 are reverse-scored.

Scores on LESS-II range from 28 to 140, with higher scores reflecting more negative beliefs about emotions, which indicate problematic emotional processing that may require therapeutic intervention (27). The original version of the LESS-II demonstrated a Cronbach's alpha of 0.82 (27). The Arabic version of the scale used in this study has previously shown similar reliability (Cronbach's alpha = 0.82) (37). In the current study, the scale's reliability was assessed again, yielding a Cronbach's alpha of 0.68, which is considered acceptable for research purposes.

Binge Eating Scale

The BES developed by Gormally *et al.* (1982) is a self-report scale to identify individuals who exhibit BED, particularly among those with obesity (25). The scale is widely used in both clinical and research practice to assess the severity of BED symptoms, providing a structured method for distinguishing between mild, moderate, and severe BED. It does not specify a fixed time frame, but instead presents a series of behavioral and attitudinal items. Each item has varying weight scores, and participants select the response that best describes their eating behaviors and attitudes. Scores on the BES range from 0 to 46, with the following classification: (0 – 16): No or mild BED, (17 – 26):

Moderate BED, and (27 above): Severe BED (38). The Arabic version of the BES demonstrated strong test-retest reliability, with a coefficient of 0.87 (39). In the current study, the BES exhibited a Cronbach's alpha of 0.82.

Bedtime Procrastination Scale

The BPS developed by Kroese *et al*. (2014) is a self-report scale to assess individuals' tendency to delay going to bed without external constraints (15). The scale was introduced in response to growing research on self-regulation failures in sleep-related behaviors, providing a standardized measure for bedtime procrastination. The scale comprises of nine items, each rated on a five-point Likert scale ranging from 1 (almost never) to 5 (almost always). Items 2, 3, 7, and 9 are reverse-scored.

The total score ranges from 9 to 45, with higher scores indicating higher levels of BP and lower scores reflecting lower sleep discipline. The original version of the BPS demonstrated a Cronbach's alpha of 0.92 (15). In the current study the Cronbach's alpha is 0.79.

Several steps were followed in accordance with the recommendations of Beaton *et al*. (2000) to adapt the BPS for use in the Middle East (40). Therefore, we used the forward and backward translation method to ensure linguistic and cultural accuracy. This process involved several meticulous steps to preserve the integrity of the original scale while making it understandable and suitable for Arabic-speaking populations.

Initially, the English version of the BPS was translated into Arabic by a professional Iraqi translator who had no prior involvement in the study. This translator was selected for their proficiency in both languages as well as their knowledge of the cultural nuances of the target population. Subsequently, an independent professor with full mastery of both English and Arabic conducted a backward translation, converting the translated Arabic version back into English. This step was critical for identifying any discrepancies or inaccuracies in the initial translation.

To assess the accuracy and consistency of the translations, the original English version and the translated English version were carefully compared by a committee consisting of the researchers and three bilingual translators. Any discrepancies or deviations from the original meaning were identified and corrected through collaborative discussions, ensuring that the final Arabic version faithfully reflects the content and purpose of the original BPS (40).

Finally, we conducted a pilot test with 30 participants from the target population to assess the clarity and comprehensibility of the translated items. Participants were asked to provide feedback on the phrasing and relevance of each item, ensuring that the items were easily understood and culturally appropriate. Based on the results of the pilot study, minor adjustments were made to enhance clarity, although no major changes were required for the scale items (41).

Through precise forward and backward translations, comprehensive evaluation by a bilingual committee, and pilot testing with the target population, the Arabic version of the BPS was successfully adapted for use in the Middle East. This process ensures that the scale is linguistically accurate and culturally relevant, thereby enabling reliable assessment of bedtime procrastination behaviors among Arabic-speaking university students.

Brief Self-Control Scale

The Brief Self-Control Scale (BSCS) developed by Tangney *et al*. (2004) is a 13-item self-report scale as a concise measure of self-regulatory capacity, reflecting an individual's ability to control impulses, emotions, and behaviors (42). The scale has been widely used in psychological research to examine self-control in relation to various behavioral and psychological outcomes. It is designed to assess five domains of self-control, namely control over thoughts, emotional control, impulse control, performance regulation and habit breaking.

Each item is rated on a five-point Likert scale ranging from 1 (not at all like me) to 5 (just like me). Items 2, 3, 4, 5, 7, 9, 10, 12, and 13 are reverse-scored. The total score ranges from 13 to 65, with higher scores indicating higher self-control while lower scores reflecting lower self-regulation.

The original BSCS demonstrated a Cronbach's alpha of 0.85. In this study, a short version of the BSCS was used, adapted from the original scale (42), with a Cronbach's alpha of 0.55. For the purpose of translating and adapting it to the Arabic culture, we followed the following:

The translation of the BSCS into Arabic followed a systematic process to ensure linguistic accuracy and cultural relevance. Initially, the original English version was translated into Arabic by a bilingual professional fluent in both languages and knowledgeable about the cultural context of the target population. This forward translation aimed to create a linguistically clear and culturally appropriate version. To verify the accuracy of this translation, a different bilingual expert with no prior involvement in the study conducted a back-translation, converting the Arabic version back into English. This step helped identify inconsistencies and ensure that the original meaning of the items was preserved.

Next, a committee of researchers and bilingual experts reviewed the original English version, the Arabic translation, and the back-translated version. Through collaborative discussions, the committee resolved any discrepancies and ensured the conceptual and linguistic equivalence of the translated scale. Adjustments were made to account for cultural differences, ensuring the Arabic version was relevant to the context and aligned with the original intent of the scale. The final Arabic version of the BSCS retained the psychometric properties of the original scale while ensuring its relevance and applicability to Arabic-speaking populations.

Irrational Procrastination Scale

The IPS was developed by Steel (2010) to assess the executive dysfunction component of procrastination, focusing on the irrational delay of tasks despite negative consequences (43). The scale is widely used to measure general procrastination tendencies, particularly in relation to self-regulation and time management failures. The IPS is a self-report scale consisting of nine items, each rated on a five-point Likert scale ranging from 1 (very Seldom or Not True of Me) to 5 (very Often True, or True of Me). Items two, six, and nine are reverse-scored. The total score ranges from 9 to 45, with higher scores indicating a higher tendency toward procrastination (43). The Arabic version of the IPS was used in this study with a Cronbach's alpha of 0.91 (44). In the current study the Cronbach's alpha was 0.65.

Statistical Analysis

The statistical methods used in this study included both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA), conducted using SPSS 26 and AMOS 24 software to identify and verify the factor structure of the Arabic version of the BPS. Exploratory Factor Analysis was performed using Principal Component Analysis with Varimax rotation. Subsequently, Confirmatory Factor Analysis was conducted to validate the structure.

Pearson correlation coefficient was used to assess the correlations between variables, and a stepwise forward regression analysis was conducted to identify the role of emotional schemas in both BES and BP, sequentially adding variables based on their contribution to the explained variance. Reliability was evaluated using Cronbach's alpha and test-retest reliability through Pearson correlation between two tests over a 28-day period.

Results

To ensure that the data followed a normal distribution, the Kolmogorov-Smirnov test and the Shapiro-Wilk test were used, both of which indicated that the data were normally distributed ($P < 0.05$). Linearity was verified by examining scatter plots. No missing data were recorded, as all participants fully completed the scales. Male participants comprised 27% of the sample, while females accounted for 73%. All participants were university students, with 34% majoring in scientific fields and 66% in humanities. Among them, 8% were married, 70% single, 17% in a relationship, and 6% in a complicated status. This demographic diversity enhances the generalizability of the findings to a broader segment of university students in similar educational contexts across the Arab world (see Table 1).

Before examining Hypothesis 1 and 2, the role of emotional schemas in BP and BED, it was necessary to examining Hypothesis 3, validating the Arabic version of the BPS. The psychometric properties of the scale were assessed using EFA, CFA, reliability and validity.

Examining Hypothesis 3: Validation of the Arabic BPS

Exploratory Factor Analysis

The rationale for using Principal Component Analysis (PCA) with Varimax rotation was to identify the underlying factor structure of the Arabic version of the BPS and enhance the interpretability of factor loadings. The use of Varimax rotation facilitated the achievement of orthogonal factors by reducing the number of variables with high loadings on each factor. Before conducting PCA, the suitability of the data was confirmed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy, which yielded a value of 0.75, indicating that the sample was adequate for factor analysis and Levene's test confirmed the homogeneity of variances (Approx. Chi-Square = 1265.192, $P < 0.001$) (45). Additionally, Bartlett's Test of Sphericity was significant ($\chi^2 = 1265.192$, $P < 0.001$), indicating that the correlation matrix properties justified the use of EFA to investigate the factor structure of the current data. The scree plot test was also used to examine the factor structure of the dataset. Factor loadings greater than 0.30 were considered statistically significant, and items with cross-loadings were excluded from further analysis, leading to the removal of item (1) (see Table 2). Cross-loading is defined as an item loading on multiple factors (46).

Table 2. Exploratory Factor Analysis (Principal-Component + Varimax) of the Arabic Bedtime Procrastination Scale: Initial Eigenvalues and Cumulative Variance for the Original 9-Item Version Versus the Revised 8-Item Version after Removing Item 1 (Sample 1, N = 835).

Component	Original Scale 9-items			Component	Delete item 1		
	Initial Eigenvalues				Initial Eigenvalues		
	Total	% Variance	Cumulative %		Total	% Variance	Cumulative %
F1	2.768	30.755	30.755	F1	2.610	32.624	32.624
F2	1.416	15.738	46.493	F2	1.409	17.617	50.241
F3	1.028	11.417	57.910	**F3**	**0.970**	**12.126**	**62.367**

Note: Bold factor is excluded due to a loading below 1.

Following EFA-1, the remaining eight items were used in EFA-2 to examine how removing item (1), which had cross-loadings, influenced the results (see Table 3). It can be observed that EFA-2 resulted in only two factors: Preparing for Bedtime (F1) encompassing items four, five, six, eight and Adherence to Bedtime (F2) encompassing items two, seven, nine, for a total of seven items. EFA-2 showed weak loadings for item (3) on both factors, leading to its exclusion from confirmatory factor analysis.

Table 3. Factor Loadings for Items of the Bedtime Procrastination Scale Based on Exploratory Factor Analysis (Sample 1, N = 835).

	Original Scale 9-Items			Delete Item-1	
	F 1	F 2	F 3	F 1	F 2
Item1	0.324	0.359	-0.488	------	------
Item 2	0.141	**0.735**	-0.019	0.136	**0.743**
Item 3	0.162	0.152	**0.883**	0.160	0.180
Item 4	**0.737**	-0.012	-0.071	**0.736**	-0.006
Item 5	**0.704**	0.009	0.049	**0.713**	0.039
Item 6	**0.741**	0.240	0.009	**0.743**	0.256
Item 7	0.264	**0.743**	-0.014	0.259	**0.755**
Item 8	**0.729**	0.130	0.018	**0.727**	0.137
Item 9	-0.123	**0.714**	0.051	-0.129	**0.721**

Note: Bold statistics are higher than 0.30 and significant (P < 0.01), F1 = Preparing for Bedtime, F2 = Adherence to Bedtime.

Confirmatory Factor Analysis

Based on the results of EFA-2, we conducted a CFA for the remaining items. We utilized the Chi-square (χ^2) index, Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Incremental Fit Index (IFI), Root Mean Square Residual (RMR), and Goodness-of-Fit Index (GFI) (47). Model fit was evaluated using widely accepted criteria. A CFI above 0.90, an RMSEA below 0.08, and a χ^2/df ratio below 3 are generally considered indicative of an acceptable model fit (47-49).

If the model fit indices were acceptable, then the standardized factor loadings are further examined to assess the strength of the correlations between the items and their scales (higher than 0.30) (47). For further analysis, a comparison was made between the single-factor model of the original scale and the two-factor model (See Table 4). The CFA results indicated that the two-factor model (after removing items 1 and 3) was the most suitable, demonstrating good fit. Additionally, all items had factor loadings higher than 0.30 for each factor (see Figure 1).

Table 4. Model Fitness Indices of the Bedtime Procrastination Scale (Sample 1, N = 835).

Models	χ2	df	χ2\df	RMSEA	GFI	AGFI	IFI	CFI	RMR
Original One-factor model	331.991	27	12.296	0.116	0.909	0.849	0.755	0.753	0.136
2-factor model-delete item 1,3	93.083	13	7.160	0.086	0.969	0.933	0.928	0.928	0.082

χ2 = chi-squared index, df = Degree of Freedom, RMSEA = Root Mean Square Error of Approximation, GFI = Goodness of Fit Index, AGFI = Adjusted Goodness of Fit Index, IFI = Incremental Fit Index, CFI = Comparative Fit Index, RMR = Root Mean Square Residual.

Table 5. Descriptive Statistics and Reliability Measures for the Bedtime Procrastination Scale, and Related Variables (Sample 3 and 2, N = 58, 490).

Variable	BPS	BP	AP	BSCS	IPS	MD	SD	α	Re-test (N)
BPS	1					22.18	5.65	0.79	0.79 (490)
BP	0.900**	1				12.74	3.37	0.72	0.75 (490)

AP	0.778**	0.564**	1			8.95	2.95	0.71	0.77 (490)
BSCS	-0.316**	-0.214**	-0.348**	1		44.06	6.40	0.55	0.69 (58)
IPS	0.390**	0.396**	0.273**	-0.539**	1	26.65	4.48	0.65	0.73 (58)

BP = Bedtime Procrastination Scale. Preparing for Bedtime, AP = Adherence to Bedtime, BSCS = Brief Self-Control Scale, IPS = Irrational Procrastination Scale. *p < 0.05, **p < 0.01

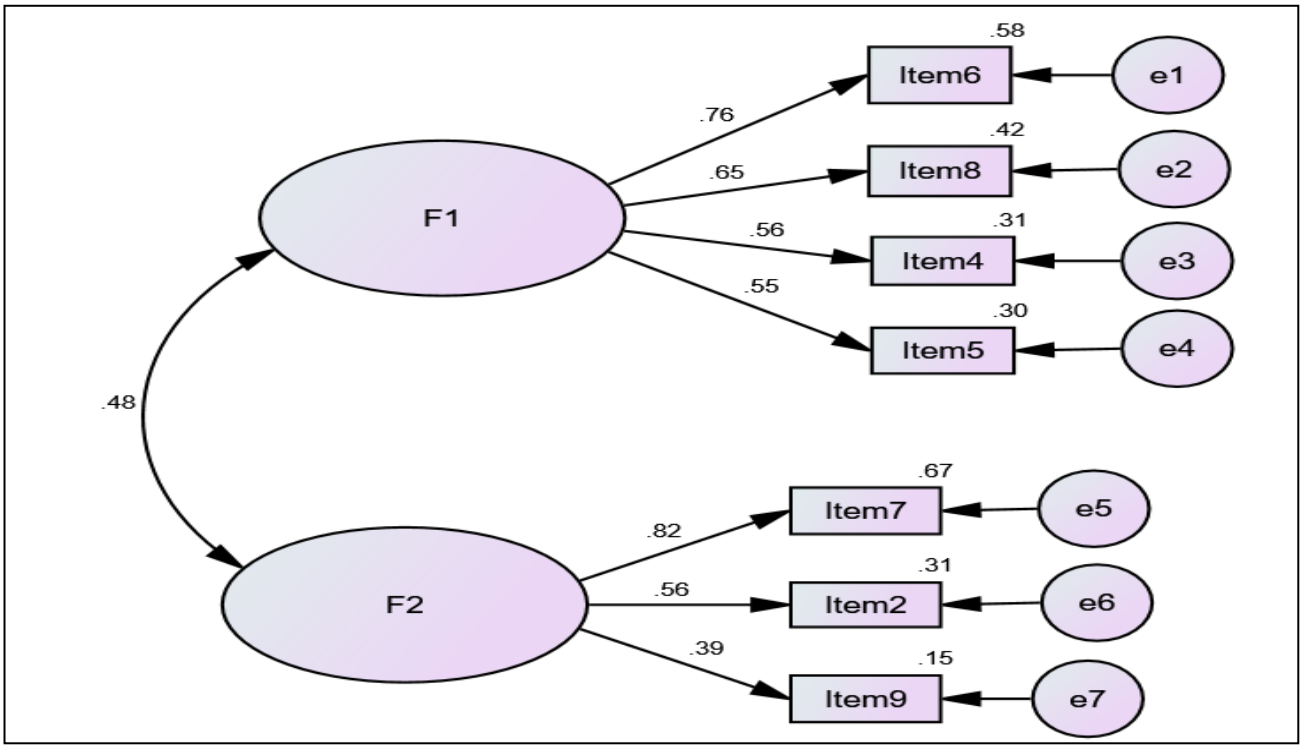

Figure 1. Confirmatory Factor Analysis for Bedtime Procrastination Scale (Sample 2, N = 490).

F1 = Preparing for Bedtime, F2 = Adherence to Bedtime.

Reliability and Validity

Convergent validity was assessed by examining the correlations between the Arabic BPS and its subscales with the IPS and the Brief Self-Control Scale (BSCS).

BPS and IPS Correlation: The BPS and its subscales demonstrated significant positive correlations with the IPS, significant at P < 0.01 (see Table 5).

BPS and BSCS Correlation: Significant negative correlations were observed between the BPS and its subscales with the BSCS, significant at P < 0.01 (see Table 5).

Internal correlations within the BPS and its subscales were also examined: BPS positively correlated with both Preparing for Bedtime (BP) and Adherence to Bedtime (AP) (see Table 5).

Finally, the Arabic BPS demonstrated good internal consistency, with a Cronbach's alpha of 0.79. Additionally, test-retest reliability (r = 0.79, P < 0.01) confirmed the scale's stability (see Table 5).

Examining Hypothesis 1 and 2: the role of emotional schemas in BP and BED

Correlations of LESS-II Scores with BED, BPS

The results revealed several statistically significant correlations between emotional schema dimensions, BES, BPS, and related variables. BES showed significant positive correlations with multiple maladaptive emotional schemas, particularly Devalued, Guilt, Incomprehensibility, Invalidation, Loss of Control, Overly Rational, Non-Acceptance of Feelings, and Simplistic View of Emotion (P < 0.01), while Blame, Low Expression, and Numbness were also significant at (P < 0.05) (see Table 6).

BPS was positively correlated with Blame, Incomprehensibility, Invalidation, Loss of Control, Non-Acceptance of Feelings, Numbness, and Rumination (P < 0.01), with additional significant correlations at (P < 0.05) (see Table 6). BP and AP subscales of the BPS also demonstrated positive associations with emotional schemas (see Table 6).

Table 6. Pearson Correlations, Mean and SD for 14-Factors (F1...F14) and Total of Leahy Emotional Schema Scale-II, Binge-Eating Scale, Bedtime Procrastination Scale and its Subscales—Preparing for Bedtime and Adherence to Bedtime in Iraqi University Students (Sample 3, N = 490).

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	LESS-II	BES	BPS	BP	AP	MD	SD
F1	1																			7.46	2.54
F2	-0.08	1																		3.76	2.06
F3	0.11*	-0.05	1																	7.33	2.37
F4	0.27**	0.03	0.08	1																7.09	2.43
F5	0.25**	0.17**	0.02	0.37**	1															5.75	2.44
F6	0.17**	0.17**	-0.09*	0.28**	0.34**	1														6.53	2.56
F7	0.27**	-0.01	0.18**	0.34**	0.44**	0.23**	1													7.57	2.82
F8	0.17**	0.00	-0.02	0.15**	0.05	0.19**	0.05	1												7.64	2.29
F9	-0.06	0.33**	-0.10*	0.11**	0.13**	0.26**	-0.06	0.03	1											4.90	2.32
F10	0.21**	0.19**	-0.00	0.35**	0.33**	0.27**	0.41**	0.05	0.17**	1										6.21	1.97
F11	0.23**	-0.07	-0.10*	0.29**	0.32**	0.20**	0.29**	0.10*	-0.02	0.15**	1									7.15	2.51
F12	0.13**	-0.56**	0.01	0.01	-0.10*	-0.12**	0.07	0.04	-0.23**	-0.05	0.15**	1								9.83	2.32
F13	0.40**	-0.18**	0.08	0.26**	0.25**	0.16**	0.38**	0.08	-0.18**	0.24**	0.25**	0.21**	1							9.08	2.45
F14	0.05	-0.53**	0.07	-0.00	-0.17**	-0.18**	0.06	0.00	-0.39**	-0.23**	0.06**	0.52**	0.23**	1						9.93	2.21
LESS	0.56**	0.04	0.21**	0.63**	0.60**	0.51**	0.67**	0.33**	0.16**	0.52**	0.51**	0.20**	0.57**	0.09*	1					100.29	13.85
BES	0.11*	0.30**	-0.00	0.15**	0.21**	0.17**	0.16**	-0.06	0.11**	0.23**	0.11**	-0.28**	0.01	-0.26**	0.17**	1				26.46	7.68

	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	LESS-II	BES	BPS	BP	AP	MD	SD
BPS	0.13**	0.07	-0.01	0.11**	0.21**	0.12**	0.21**	0.09*	0.00	0.16**	0.15**	0.03	0.14**	0.03	0.26**	0.17**	1			22.18	5.65
BP	0.15**	0.03	-0.00	0.10*	0.18**	0.06	0.22**	0.06	-0.03	0.15**	0.13**	0.04	0.17**	0.08	0.24**	0.17**	0.90**	1		12.74	3.37
AP	0.00	0.16**	-0.03	0.06	0.09*	0.19**	0.04	0.08	0.12**	0.13**	0.02	-0.06	-0.00	-0.10*	0.12**	0.10*	0.77**	0.56**	1	8.95	2.95

F1 = Blame, F2 = Devalued, F3 = Duration, F4 = Guilt, F5 = Incomprehensibility, F6 = Invalidation, F7 = Loss of control, F8 = Low consensus, F9 = Low expression, F10 = Non-acceptance of feelings, F11 = Numbness, F12 = Overly rational, F13 = Rumination, 14 = Simplistic view of emotion, LESS-II = Leahy Emotional Schema Scale-II, BES = Binge-Eating Scale, BPS = Bedtime Procrastination Scale, BP = Preparing for Bedtime, AP = Adherence to Bedtime. *P < 0.05, **P < 0.01

Stepwise Regression Analysis

First, the stepwise regression analysis identified six significant predictors of binge eating scores, explaining 18.2% of the total variance: Devalued emerged as the strongest predictor, initially accounting for 9.3% of the variance. Non-acceptance of feelings significantly contributed an additional 3.3%. Overly rational was negatively associated with BES, suggesting a potential protective effect against binge eating. Numbness, Blame, and Low Consensus were also included in the final model, each contributing small but significant portions to the explained variance (see Table 7).

Second, the stepwise regression analysis identified three significant predictors of bedtime procrastination, collectively explaining 5.8% of the variance in BPS scores. Incomprehensibility was the strongest predictor, initially accounting for 4.3% of the variance. Non-acceptance of feelings further increased the explained variance to 5.5%. Simplistic view of emotion was added in the final step, contributing a smaller effect but reinforcing the role of emotional schemas in bedtime procrastination (see Table 8).

Table 7. Summary of Stepwise Regression Analysis for Variables Predicting Participants Binge Eating Score (N = 490)

	Variable Name	R	R^2	R Change	B	SE B	β	t	Sig
1	(Constant)	0.308	0.095	0.093	22.142	0.688		32.196	0.000
	Devalued				1.147	0.160	0.308	7.162	0.000
2	(Constant)	0.354	0.126	0.122	18.323	1.148		15.965	0.000
	Devalued				1.018	0.161	0.274	6.338	0.000
	Nonacceptance of feelings				0.692	0.168	0.178	4.119	0.000
3	(Constant)	0.383	0.147	0.141	25.246	2.296		10.994	0.000
	Devalued				0.640	0.193	0.172	3.323	0.001
	Nonacceptance of feelings				0.728	0.167	0.187	4.375	0.000
	Overly rational				-0.582	0.168	-0.177	-3.468	0.001
4	(Constant)	0.405	0.164	0.157	23.486	2.343		10.023	0.000
	Devalued				0.652	0.191	0.175	3.412	0.001
	Nonacceptance of feelings				0.640	0.167	0.165	3.825	0.000
	Overly rational				-0.651	0.168	-0.197	-3.878	0.000
	Numbness				0.411	0.130	0.134	3.151	0.002
5	(Constant)	0.415	0.173	0.164	22.342	2.388		9.358	0.000

	Devalued				0.672	0.190	0.181	3.529	0.000
	Nonacceptance of feelings				0.565	0.170	0.145	3.321	0.001
	Overly rational				-0.678	0.168	-0.206	-4.048	0.000
	Numbness				0.353	0.132	0.116	2.672	0.008
	Blame				0.297	0.132	0.099	2.259	0.024
	(Constant)				24.248	2.505		9.681	0.000
	Devalued				0.686	0.190	0.184	3.619	0.000
	Nonacceptance of feelings				0.566	0.169	0.145	3.345	0.001
6	Overly rational	0.427	0.182	0.172	-0.666	0.167	-0.202	-3.996	0.000
	Numbness				0.372	0.132	0.122	2.825	0.005
	Blame				0.346	0.132	0.115	2.612	0.009
	Low consensus				-0.338	0.141	-0.101	-2.405	0.017

Table 8. Summary of Stepwise Regression Analysis for Variables Predicting Participants Bedtime Procrastination Score (N = 490)

Model	Variable Name	R	R^2	R Change	B	SE B	β	t	Sig
1	(Constant)	0.213	0.045	0.043	19.358	0.639		30.292	0.000
	Incomprehensibility				0.492	0.102	0.213	4.812	0.000
2	(Constant)	0.234	0.055	0.051	17.993	0.891		20.192	0.000
	Incomprehensibility				0.412	0.108	0.178	3.810	0.000
	Nonacceptance of feelings				0.293	0.134	0.102	2.189	0.029
3	(Constant)	0.253	0.064	0.058	14.978	1.641		9.128	0.000
	Incomprehensibility				0.436	0.108	0.189	4.032	0.000
	Nonacceptance of feelings				0.350	0.136	0.122	2.575	0.010
	Simplistic view of emotion				0.253	0.116	0.099	2.185	0.029

Dependent Variable: Bedtime Procrastination

Discussion

Hypothesis 1: Maladaptive emotional schemas positively contribute to the severity of BED and BP among university students.

Our results revealed significant correlations between emotional schemas and binge eating, with maladaptive schemas. In more details, the results underscored significant correlations between factors of emotional schemas and BES. Specifically, BES was correlated with several factors of emotional schemas, including devalued, incomprehensibility, invalidation, and non-acceptance of feelings. This suggests that individuals who perceive their emotions as invalid or incomprehensible may engage in binge eating as a maladaptive strategy to regulate negative emotional states. Additionally, factors like guilt and rumination also showed positive correlations with BES, highlighting the role of self-critical and repetitive thought patterns in exacerbating this behavior. These findings support Leahy's hypothesis that schemas such as emotional invalidation and lack of understanding can drive maladaptive mechanisms. Similarly, Dingemans *et al.* found similar links between maladaptive emotion regulation strategies and binge eating (50). Conversely, binge eating was negatively correlated with overly rational and simplistic view of emotion, suggesting that individuals who rely on logical thinking to regulate emotions are less likely to engage in binge eating. This

aligns with Leahy's model, which posits that a controlled and rational approach may serve as a protective factor by suppressing impulsive emotional responses correlated with binge eating. However, while rationality may reduce tendencies toward binge eating, excessive reliance on it might also suppress healthy emotional expression, potentially leading to other psychological or relational challenges.

Emotional schemas accounted for 18% of the variance in binge eating, underscoring their pivotal role in maladaptive eating behaviors. This result aligns with research showing that emotion dysregulation, anxiety, and depression are key contributors to eating disorders (51-54), with anxiety and depression often stemming from maladaptive emotional schemas (26, 31, 55). In other words, maladaptive emotion regulation leads to anxiety and depression, which in turn contribute to binge eating disorder. A meta-analysis further supports the direct link between eating disorders and emotion dysregulation (56), highlighting the need to address emotional schemas to improve emotional responses and reduce maladaptive behaviors. Similarly, emotional schemas also influence bedtime procrastination, reinforcing their broader impact on self-regulation difficulties.

More specifically, devalued emotions were the most influential (9%). This finding underscores how a lack of purpose can drive individuals to engage in self-destructive behaviors, such as binge eating. Previous studies support this, indicating that a lack of meaning in life leads to eating disorders (57). Individuals without a clear life purpose are more prone to anxiety, depression, and stress (58), which diminishes their ability to prioritize their psychological and physical health, leading to maladaptive behaviors that harm physical and mental health, such as weight gain, obesity, and related health issues. In other words, having meaning in life acts as a system that fosters and sustains psychological health and well-being (59). This view aligns with research emphasizing the protective and guiding role of meaning in life in mitigating unhealthy behaviors (60).

Non-acceptance of feelings plays a significant role in the development and maintenance of binge eating, as evidenced by our findings, which indicate that it accounts for 3% of the variance in binge eating. Non-acceptance of feelings fosters maladaptive cognitive and behavioral responses to emotional experiences. According to Leahy (2016), individuals reject their emotions rather than allowing themselves to experience and process them. This rejection reinforces emotional suppression, which has been strongly correlated to eating disorders (61, 62). Additionally, the inability to manage emotions adaptively is correlated with reduced psychological flexibility, heightened stress, and impaired emotional regulation, all of which amplify disordered eating behaviors (63).

This suggests that suppressed emotions often resurface through maladaptive methods, including binge eating and emotional eating (27, 64). These findings highlight the therapeutic potential of emotion-focused therapy and acceptance-based interventions, which aim to enhance emotional processing and reduce reliance on avoidance behaviors (27, 65).

Interestingly, overly rational, which emerged as a negative predictor, reduced the likelihood of binge eating by 2%, suggesting a protective role against maladaptive eating behaviors. As Leahy (2016) posits, individuals who emphasize rationality may engage in cognitive processes that counteract the impulsive and emotionally driven tendencies associated with binge eating. This rational approach might enable them to manage emotional triggers more effectively, reducing the need to resort to binge eating as a coping mechanism. Excessive reliance on rationality can inhibit adaptive emotional processing, such as validation, acceptance, and expression of emotions, potentially leading to other psychological or relational challenges (27, 62).

Contribution of numbness, accounting for 2% of binge eating in this study, can be explained by its role as a cognitive defense mechanism against intense emotional experiences, as suggested by Leahy (2016). Numbness allows individuals to detach from overwhelming emotions by reducing their intensity. However, this state of emotional detachment prevents appropriate emotional processing, leaving the distress unresolved (26, 27), often leading to maladaptive behaviors such as binge eating. Binge eating serves as a maladaptive strategy to fill the void created by emotional detachment. The functioning of this mechanism is supported by the findings of Mason *et al.*, which indicated that emotional detachment led to reliance on food for comfort (66).

Blame and low consensus each contributed 1% to binge eating, a minor contribution compared to other schemas. This result can be explained by suggesting that individuals blame others for certain emotions rather than taking responsibility. The blame schema reinforces an external locus of control over the causes of emotional states, thereby reducing emotional self-regulation and increasing engagement in binge eating behaviors (67, 68). This finding is supported by previous research, including one study that showed a strong correlation between an external locus of control and binge eating disorder (69). According to Leahy (2016), when the blame schema is activated, individuals often feel helpless and emotionally disconnected, perpetuating feelings of helplessness and prolonging emotional distress. This, in turn, leads to a vicious cycle of emotion avoidance and suppression (26, 27).

On the other hand, the low consensus schema reflects difficulty in recognizing and validating one’s emotions as shared or normal human experiences, which emerged as a negative predictor, reducing the likelihood of binge eating by 1%. Leahy (2016) emphasizes that normalizing emotions (helping individuals understand that others experience similar emotions) is a critical step in reducing

emotional distress (27). Without this normalization, individuals may feel isolated, which can exacerbate depression. Notably, depression is closely correlated to anorexia nervosa, or the reluctance to eat (70, 71).

Hypothesis 2: Maladaptive emotional schemas positively contribute to the severity of BP among university students.

BP was significantly correlated with several factors of emotional schemas such as invalidation, non-acceptance of feelings, incomprehensibility, loss of control, and rumination. Invalidation reflects the perception that others do not accept one's feelings, which may lead to procrastination as a natural consequence of one's feelings not being accepted by others. Incomprehensibility to understand emotions highlights the role of emotional confusion, leading to procrastination when feelings remain unresolved. Feelings of loss of control exacerbate these delays, as individuals are overwhelmed by emotion struggle with structured routines, while rumination prolongs engagement with negative feelings, resulting in delayed bedtime. These findings align with Sirois and Pychyl (2013), who linked procrastination to emotional regulation difficulties, emphasizing the need for interventions that enhance emotional understanding and adaptive coping strategies (72).

Our results also showed that the overall contribution of emotional schemas (incomprehensibility, non-acceptance of feelings, and simplistic view of emotion) to bedtime procrastination accounted for 6% of the variance. This contribution is small compared to the contribution of emotional schemas to BES, but it remains noteworthy as it highlights the role of emotional processing in bedtime procrastination. Some maladaptive emotional schemas can disrupt emotional regulation, amplify emotional distress, and promote avoidant behaviors (26, 27). This aligns with the findings of Sirois *et al*., who discovered that bedtime procrastination serves as a way to escape negative emotions (73). Research supports the notion that bedtime procrastination is closely tied to increased social media usage and the fear of missing out, both of which serve as mechanisms for avoiding emotional distress. For example, Zhang *et al.* found that problematic smartphone use and fear of missing out are significant predictors of bedtime procrastination among adolescents. These behaviors are driven by the desire to stay connected and avoid the anxiety of being excluded, which leads to delayed sleep as a coping mechanism for underlying emotional discomfort (74). Moreover, a systematic review and meta-analysis highlighted a strong association between fear of missing out and poor sleep health, demonstrating that fear of missing out not only contributes to delayed bedtimes but also negatively affects overall sleep quality (75). This suggests that individuals may procrastinate going to bed to escape or distract themselves from negative emotions, using social media engagement as a short-term relief strategy. BP, as an avoidance mechanism, allows individuals to delay confronting unresolved feelings, consistent with the view that procrastination represents a failure in self-regulation (15). Our findings are consistent with Leahy's proposition that maladaptive emotional schemas amplify avoidance mechanisms.

Hypothesis 3: The Arabic adaptation of the BPS will demonstrate a robust factorial structure and exhibit sound psychometric properties, consistent with previous adaptations in other cultural contexts.

The Arabic version of the BPS demonstrated a robust two-factor model, consistent with findings from the Japanese (21) and Persian (22) versions but differing from the Turkish (19) and Chinese (20) versions, which emphasized a single-factor structure. This suggests that cultural and linguistic differences significantly influence the understanding of bedtime procrastination. Furthermore, the correlation between bedtime procrastination and general procrastination reinforced the idea that procrastination tendencies extend across different life domains, as noted in prior studies (15, 16). Individuals prone to general procrastination often exhibit poor self-control and planning abilities, contributing to delayed bedtime and subsequent sleep deprivation (15, 76). This was confirmed by our study, which showed a strong positive association between bedtime procrastination and general procrastination and a negative association with self-control, thus achieving convergent validity for the Arabic version of the BPS. Regarding the scale's structure, Item 1 exhibited cross-loadings and was excluded from subsequent analyses, consistent with best practices in scale development, where cross-loadings can sometimes raise concerns about factor validity (77). Additionally, Item 3 was excluded in the second exploratory factor analysis, as it is recommended to remove items with loadings below 0.30 on a factor (78). Results from confirmatory factor analysis demonstrated good fit indices for the two-factor model compared to the one-factor model. Finally, the BPS exhibited acceptable internal consistency and stability, supporting its unbiased applicability.

Limitation

The study's reliance on university students limits the generalizability of findings to other populations, such as older adults or those outside academic settings. Also, we acknowledge the gender imbalance in our sample, with female participants comprising a larger proportion (73%). This discrepancy reflects sampling limitations rather than an intentional bias in participant selection. While this may impact the generalizability of our findings, particularly regarding potential gender-based differences in BED and BP, the focus of this study was not to examine gender differences in these behaviors. Furthermore, while statistical analyses comparing gender differences could provide additional insights, they fall outside the scope and primary objectives of this study.

Self-reported measures may have introduced response biases, including inaccuracies in BMI reporting and social desirability effects. In addition, one of the most significant limitations of this study may be the low internal consistency value (Cronbach's alpha) for most of the study scales. Another limitation is that the number of individuals in the convergent validity sample is small.

Future Directions

Future studies should aim to develop interventions to address maladaptive emotional schemas. Emotion-focused therapy, acceptance and commitment therapy, or meaning-centered therapy could enhance emotional regulation and reduce binge eating. Meanwhile, cognitive-behavioral interventions focusing on time management and emotional awareness might effectively reduce bedtime procrastination. Additionally, expanding research to include both Arab and non-Arab cultures offers an opportunity to understand cultural differences in emotional schemas and their impact, ensuring the design of culturally adaptive and effective interventions.

Future research also should aim to enhance the generalizability of findings by incorporating diverse populations beyond university students, such as older adults and individuals outside academic settings. Additionally, while this study did not focus on gender differences, future studies with more balanced samples could investigate the potential impact of gender on the relationships between emotional schemas, BED, and BP.

Given the reliance on self-reported measures, future research should consider incorporating objective behavioral assessments to mitigate response biases, such as inaccuracies due to social desirability effects. Additionally, efforts should be made to improve the internal consistency of study scales, ensuring that measurement tools are robust and reliable across different populations. Moreover, future studies should address the small sample size used in the convergent validity analysis by increasing the number of participants to strengthen the reliability of validation efforts.

Conclusion

This study demonstrated the significant role of emotional schemas in influencing BES and BPS among university students. The findings indicate that BES is strongly correlated with emotional schemas such as devalued and non-acceptance of feelings, while BPS is correlated with difficulties in understanding and accepting emotions, as well as a simplistic view of emotion. These results highlight the impact of emotional dysfunction on self-regulatory behaviors and underscore the clinical importance of addressing maladaptive emotional schemas. Furthermore, the Arabic adaptation of the BPS was proven to be a valid and reliable tool for assessing BP in Arabic-speaking populations. The study's findings contribute to the broader understanding of how emotional schemas shape behavioral regulation, emphasizing the need for targeted interventions that enhance emotional processing and coping mechanisms. Addressing maladaptive emotional schemas may provide a promising avenue for improving emotional regulation and reducing behaviors such as binge eating and bedtime procrastination.

Acknowledgment

The authors would like to thank Mustansiriyah University (Baghdad, Iraq) for its invaluable support in the completion of this research. Special thanks are also due to the esteemed professors for their contributions to the translation, revision, and modification of the research scales, and for providing advice and guidance without charge.

Conflict of Interest

None.

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