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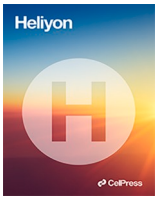

Research article

# The psychometric properties of the Arabic version of the dieting beliefs scale (DBS)

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ABSTRACT

*Background:* There are relatively few data about the association between locus of control and weight loss in Arabic populations. A tool does exist, the Dieting Belief Scale (DBS), that was designed to measure individuals' beliefs regarding their ability to control their body weight. The aim of this study was to translate this tool into Arabic and to evaluate its psychometric properties.
*Methods:* The forward translation of the DBS from English to Arabic was completed by two professional bilingual translators, while the back translation from Arabic to English was independently performed by another two different professional bilingual translators. An online survey using the tool was then completed by 245 participants, fully aware of the study's purpose. Psychometric analyses were subsequently conducted to assess the reliability and validity of the Arabic DBS.
Internal consistency was examined using Cronbach's α and McDonald's ω coefficients. Test-retest reliability was also assessed. Confirmatory factor analysis was employed to evaluate the fit of a three-factor model, with indices including Comparative Fit Index (CFI), Tucker Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Convergent validity was assessed by examining the correlation between the Arabic DBS and the Eating Attitude Test (EAT-26) previously translated into Arabic, the latter identifying attitudes, feelings and behaviors related to eating.
*Results:* The Arabic translated DBS scale demonstrated high translation accuracy and content validity estimates. Cronbach's α and McDonald's ω reliability coefficients for the translated scale

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were approximately 0.91. Test-retest reliability was 0.96. The three-factor model showed an acceptable fit (CFI = 0.93, TLI = 0.92, RMSE = 0.08, SRMR = 0.06). The Arabic version of the DBS was found to have good convergent validity, as evidenced by the significant correlation between the EAT-26 and DBS questionnaires ($r = 0.53$, $p < 0.01$).
*Conclusion:* The Arabic version of the DBS is highly reliable and has sufficient content validity to measure belief about personal ability to control one's weight.

## 1. Introduction

Disordered eating, as well as problems associated with body image and body weight, have risen dramatically in Arab nations over the past few decades, paralleling an increased exposure to Western media and shifting standards of what constitutes ideals of attractiveness and desirability in both men and women [1–3]. As a result, studies estimate disordered eating prevalence in Arabia and the Middle East to range between 10% and 50%, with high rates of body image dissatisfaction, extreme dieting behaviors, and associated psychological distress [1,2]. The nutrition transition away from traditional whole foods towards fast food diets high in fat, sugar and refined grains has been linked to the rising incidence of eating disorders in the region [4]. Researchers have identified numerous sociocultural factors that potentially contribute to these problems within Arab populations, including a growing emphasis on a slim body for women, changes in traditional gender roles, and conflicts between modern and traditional values [2,5].

In contrast to what is now seen as desirable, weight gain has become widespread in the Arab region, especially in Egypt, Jordan, Saudi Arabia, Kuwait, Bahrain, and the United Arab Emirates, with prevalence rates of overweight of approximately 70% and 80% in men and women, respectively [6].

Alongside stress-inducing sociocultural pressures, individual personality traits such as locus of control have been implicated in the development and maintenance of dysfunctional dieting attitudes [7]. Locus of control refers to one's perceived ability to exert control over life events [8]. Individuals with a more external locus of control believe that what happens to them is determined by external factors beyond their control, while individuals with a more internal locus of control believe that events and their consequences depend primarily on personal actions and behaviors [9]. In eating disorder research, an external locus of control has been linked to increased dieting frequency and rigidity, lower self-esteem, and higher rates of diagnosed eating disorders, as these individuals try, usually unsuccessfully, to resist societal pressures against which they feel powerless [8,10].

Given the relationships between dieting beliefs, locus of control, disordered eating, and unwanted weight gain, it seems important to develop instruments that assess not only the presence of dysfunctional cognitions about body image, but also one's sense of agency in regard to personal actions and their outcomes [11,12]. Research and clinical efforts to address disordered eating in Arab countries have been hampered by a lack of validated assessment tools. The development of available measures is always critical for understanding thought patterns, experiences, and behavioral motivations of peoples of diverse cultures and traditions [1,2]. Such measures can aid early intervention and inform culturally-appropriate treatment approaches.

The Dieting Beliefs Scale (DBS) [13] represents one well-established eating disorders assessment tool that had not been translated into Arabic. It is based on the concept of locus of control, which can be described as the belief that individuals have the capacity to influence or regulate their weight to some extent [13]. The DBS consists of 16 items addressing equal numbers of external and internal factors that affect one's weight [13]. The scale exhibits strong psychometric properties across English-speaking populations, including high internal consistency, test-retest reliability, and criterion validity [13]. The sociocultural influences and maladaptive thoughts patterns addressed in this questionnaire are pertinent to factors previously shown to contribute to eating disorders in Arab nations [1,2]. Adaptation of this brief, empirically-validated scale could provide clinicians and researchers in the Middle East with an efficient, reliable tool for elucidating problematic dieting views underlying disordered eating behaviors.

Therefore, this study aimed to translate the DBS into Arabic and evaluate its reliability and validity for use in the Arabic cultural context. Establishing the value of such an instrument can help to speed assessment while, in itself, providing insight into beliefs that may impede healthy relationships with food and body image among Arab populations. Findings should be able to inform prevention and early intervention efforts targeting disordered eating cognitions in the Middle East.

## 2. Method

### 2.1. The translation process

Prior to the translation process, the research team sought and obtained formal written approval from the developers of the DBS scale to proceed with its translation. The original DBS English version of the scale was initially translated to Arabic and then back to English by independent bilingual translators [14]. The forward translation of the DBS from English to Arabic was completed by two professional bilingual translators, while the back translation from Arabic to English was independently performed by another two different professional bilingual translators. The research team compared the final translated Arabic version of the scale with the original English version to ensure that the meaning in Arabic accurately reflected the English meaning. All inconsistencies were resolved by the group. See Supplement 1 for the original English language version and the Arabic version of the scale. No changes or adaptations were made to the Arabic translation to account for cultural or traditional idiosyncrasies.

### 2.2. Data collection

Participants were recruited from four Arab countries (Bahrain, Egypt, Jordan, and Tunisia) through social media platforms. A total of 245 participants completed the entire survey, thus providing demographic information (age, gender, marital status, and weight/height$^2$ so that BMI could be calculated) and responses to the Arabic version of the DBS scale as well as the EAT-26 scale.

Based on the rule of 5–10 participants per item in the DBS; thus, we estimated that a minimum sample size of 160 participants was required for meaningful analysis [15].

### 2.3. Measures

#### 2.3.1. The dieting beliefs scale (DBS)

The DBS scale is based on the hypothesis that the strength of individual belief and, thus, one's expectancy of being able to control one's weight is important to diet adherence over time. The scale consists of 16 items addressing equal numbers of external and internal factors that are known to influence dieting and weight [13]. The internal locus of control with respect to weight is the degree of a person's beliefs that weight is determined by personal behavior (i.e., effort, self-schooling, will power) while the external locus of control regarding weight is the degree of a person's beliefs that outside factors such as genetics, family history, chance, and exposure to social pressure determine weight [13]. Potential responses to the 16 items are answered on a six-point Likert type, ranging from 1 (not my belief at all) to 6 (my extremely strong belief) [13]. A total score is then computed (range 16–96), a higher score indicating a stronger belief in one's ability to keep weight under control [13]. The original authors of the scale discussed each item's psychometric and theoretical value by removing items one at a time [13]. They found that, of the 16 items, 13 had an item-total correlation of 0.2 or greater [13]. The factor analysis conducted on the 13 items of the original scale indicated a three-factor solution consisting of: Subscale 1/Factor 1: Internal control over weight. Subscale 2/Factor 2: Chance, genetics, and weight. Subscale 3/Factor 3: Environment and weight scales [13].

#### 2.3.2. The Eating Attitudes Test (EAT-26)

The Eating Attitudes Test (EAT-26) is one of the most widely used standardized measures of symptoms and concerns related to eating disorders. Developed by Garner et al. (1982) [16], the EAT-26 is a 26-item self-report questionnaire that assesses disordered eating attitudes and behaviors across three subscales: Dieting, Bulimia and Food Preoccupation, and Oral Control [16]. Respondents rate each item on a 6-point Likert scale from "always" to "never" [16]. Sample statements include "I am terrified about being overweight", "I avoid eating when I am hungry", and "I feel that food controls my life" [16]. The EAT-26 exhibits strong internal consistency and test-retest reliability. Extensive research has also supported its criterion validity in both clinical and non-clinical populations across age groups and cultural settings. A score of 20 or above (out of a total of 78) is considered a risk for the expression of an eating disorder [17]. The Cronbach's alpha for EAT-26 was found to be 0.90 [16]. The EAT-26 is available in Arabic [18] with a comparable reliability to the original English instrument.

The EAT-26 was selected to evaluate convergent validity with the translated Arabic DBS due to its standing as one of the most widely used and psychometrically supported measures of disordered eating cognitions and behaviors. In particular, the EAT-26 contains a dieting subscale directly related to the assessment of dysfunctional dieting attitudes on the DBS. Significant positive correlations were predicted between the Arabic DBS and Arabic EAT-26 total and subscale scores. This allows examination of the degree to which the Arabic DBS effectively captures beliefs that can lead to disordered eating.

### 2.4. Ethics

Ethical approval was received from the Institutional Review Board at the University of El Kef, Tunisia (047–2023). Participation was completely voluntary; all participants were able to withdraw from the study at any time. Although participation was voluntary and participants had the option to withdraw from the study at any time, no one chose to do so. All participants were over age 18 and provided written informed consent prior to entering the study.

### 2.5. Statistical analysis

The descriptive statistics (mean, standard deviation (SD), skewness, and kurtosis) were performed, and internal consistency was tested with Cronbach's alpha, McDonald's omega, and composite reliability (CR). Cronbach's alpha and CR higher than 0.6 and 0.7, respectively, were considered acceptable [19]. The interclass coefficient (ICC) was used to evaluate the scale's stability over time. To compute the ICC, participants were required to complete the DBS twice, with a two-week gap between administrations. However, to reduce the burden on the entire sample, we made this second administration optional for participants. We set a minimum needed sample size of 100 participants to complete the DBS twice in order to ensure sufficient statistical power for estimating the ICC. These study subjects ($n = 112$) were selected randomly from the larger pool.

Procedure confirmatory factor analysis (CFA) was performed to examine the factor structure of the Arabic version of the DBS. CFA was computed to initially examine a one factor solution and, later, a three-factor structure of the scale. The overall model fit was assessed using multiple goodness-of-fit indices, including the Chi-square value, Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA) accompanied by its 95% confidence interval (95% CI) and Standardized Root Mean Square Residual (SRMR). R statistical software version 4.3.1 (Beagle Scouts) was used to perform all analyses; statistical significance was set at p-value

<0.05. The package "lavaan" [20] was utilized for conducting CFA in this study, using the maximum likelihood estimator (MLE).

Model fit was evaluated using several criteria, including the exact model test, examination of residual statistics, and incremental fit indices [21,22]. While the chi-square exact model test provides an overall test of model fit, it can be overly sensitive to sample size and model complexity [21,22]. Thus, the model fit was assessed using common fit indices including CFI, TLI, RMSEA, and SRMR [21,22]. Residual statistics, including standardized residuals and modification indices (MI), were inspected to identify points of local strain in the model [21,22]. Standardized residuals outside of ± 2.58 indicate observations poorly accounted for by the model [21,22]. Large modification indices suggest misspecified parameters [21,22]. This multifaceted approach provides a comprehensive evaluation of both global and local model fit.

Reliability and validity of the factors were examined through factor loadings, Fornell-Larcker criterion and related tests of the Heterotrait-Monotrait ratio (HTMT), and average variance extracted (AVE). The model is considered acceptable when the CFI/TLI values are close to 1 [23], indicating a good fit and an RMSEA of 0.05 or more indicating a better-fit model [24].

Finally, we computed Pearson's correlation between the DBS scale (and its subscales) and the EAT-26 scale (and its subscales) to assess the convergent validity of the Arabic version of the DBS questionnaire.

## 3. Results

A sample of 245 participants was analyzed. Continuous variables included age ($M = 23.11$, $SD = 7.59$), height in centimeters ($M = 165.15$, $SD = 10.42$), weight in kilograms ($M = 64.82$, $SD = 14.52$), and body mass index (BMI) in kg/m2 ($M = 23.70$, $SD = 4.39$). Categorical variables included sex, with 194 female participants (79%) and 51 male participants (21%), as well as marital status, with 36 married participants (15%) and 209 single participants (85%). Descriptive results of the study participants are shown in Table 1.

Table 2 presents descriptive statistics for the variables measured in the study. The variables include the DBS items (DBS1-DBS16). The "Total DBS" represents the sum of all DBS item scores. The table also includes subscale scores within the DBS, namely Subscale 1 (Internal control over weight), Subscale 2 (Chance, genetics, and weight), and Subscale 3 (Environment and weight scales). Furthermore, the table provides scores on the EAT-26 scale, which measures eating disorder symptoms. The EAT-26 subscales are also reported, including Subscale 1 (Dieting), Subscale 2 (Bulimia and Food Preoccupation), and Subscale 3 (Oral Control). The overall DBS mean score was $M = 67.1$ ($SD = 14.22$). To describe the normal distribution of the data, skewness, and kurtosis were calculated for each item, and acceptable skewness (ranging between −0.87 and 0.16; mainly skewed) and kurtosis (ranging between −0.98 and 0.18; mainly leptokurtic) values were found. Details are in Table 2.

McDonald's omega, the internal consistencies (Cronbach's alphas), and the ICC were used to evaluate the scale's accuracy. The total scale demonstrated acceptable to excellent reliability $\alpha = 0.91$; $\omega = 0.91$; and ICC = 0.96.

Initially fitting a one-factor solution yielded poor fit indices $\chi^2$ (df) = 375.18 (104), $p < 0.001$, TLI = 0.81, CFI = 0.83, SRMR = 0.06, and RMSEA = 0.10. See Table 3. The residual variances for all indicators were statistically significant, suggesting the presence of unexplained variance. The indicators with the largest residual variances were DBS5 (1.63) and DBS8 (1.52). Examination of the modification indices identified several areas of potential strain. The largest residual covariance was between DBS5 and DBS6 (MI = 29.5). Other large residual covariances were found between indicators measuring the same latent factors, such as DBS9 and DBS10 (MI = 25.69). Additional strain was evidenced by substantial predicted cross-loadings between some indicators and unintended factors.

Therefore, the three-factor model was fitted based on the 13 items identified by the original authors; the analysis supported the three-factor structure of the 13-item DBS. Factor loadings were statistically significant ($p < 0.001$) and ranged from 0.50 to 1.22, indicating the items were good measures of the underlying factors. Factor 1 (internal control over weight) consisted of 5 items, Factor 2 (chance, genetics, and weight) contained 5 items, and Factor 3 (environment and weight) had 3 items. See Fig. 1.

The measurement model demonstrated adequate fit to the data overall, based on several fit indices (CFI = 0.934, TLI = 0.917, NFI = 0.894, RFI = 0.867, IFI = 0.935). While the RMSEA of 0.077 was higher than the recommended 0.06 cut-off, the RMSEA 95% confidence interval of 0.061–0.092 still indicated reasonable fit. The HTMT ratios between the factors were all below 0.90, providing evidence of discriminant validity. Specifically, the HTMT ratio between Factor 1 and 2 was 0.809, between Factor 1 and 3 was 0.702,

**Table 1**
Descriptive results of the study participants $n = 245$.

| Continuous variables | Means | Standard deviations |
|---|---|---|
| Age | 23.11 | 7.59 |
| Height (cm) | 165.15 | 10.42 |
| Weight (kg) | 64.82 | 14.52 |
| BMI (kg/m2) | 23.70 | 4.39 |
| **Categorical variables** | **Counts** | **Percentages** |
| Sex | | |
| Female | 194 | 79 % |
| Male | 51 | 21 % |
| Marital status | | |
| Married | 36 | 15 % |
| Single | 209 | 85 % |

**Notes:** Results expressed as arithmetic means and standard deviations for continuous data and counts and percentages for categorical data.

**Table 2**
Descriptive results of the Dieting Beliefs Scale (DBS) and Eating Attitudes Test (EAT-26) $n = 245$.

| Variables | Mean | Standard deviation | Skewness | Kurtosis |
|---|---|---|---|---|
| DBS1 | 4.61 | 1.17 | −0.62 | −0.06 |
| DBS2 | 4.48 | 1.19 | −0.59 | 0.00 |
| DBS3 | 3.96 | 1.40 | −0.26 | −0.79 |
| DBS4 | 3.87 | 1.43 | −0.15 | −0.83 |
| DBS5 | 3.26 | 1.65 | 0.16 | −1.17 |
| DBS6 | 3.77 | 1.48 | −0.15 | −0.94 |
| DBS7 | 3.80 | 1.47 | −0.15 | −0.89 |
| DBS8 | 4.58 | 1.39 | −0.79 | −0.14 |
| DBS9 | 4.31 | 1.35 | −0.48 | −0.60 |
| DBS10 | 4.63 | 1.29 | −0.86 | 0.15 |
| DBS11 | 4.69 | 1.27 | −0.85 | 0.18 |
| DBS12 | 4.50 | 1.22 | −0.56 | −0.31 |
| DBS13 | 4.49 | 1.26 | −0.65 | −0.12 |
| DBS14 | 3.69 | 1.50 | −0.12 | −0.93 |
| DBS15 | 4.26 | 1.34 | −0.60 | −0.21 |
| DBS16 | 4.28 | 1.34 | −0.62 | −0.22 |
| Total DBS | 67.17 | 14.22 | −0.30 | 0.99 |
| Subscale 1: Internal control over weight | 22.39 | 5.05 | −0.74 | 0.75 |
| Subscale 2: Chance, genetics, and weight | 19.35 | 5.36 | 0.09 | −0.24 |
| Subscale 3: Environment and weight scales | 11.84 | 3.60 | −0.11 | −0.65 |
| EAT-26 | 18.51 | 8.76 | 2.54 | 0.89 |
| Subscale 1: Dieting | 11.60 | 6.94 | 0.79 | −0.02 |
| Subscale 2: Bulimia and Food Preoccupation | 2.19 | 2.80 | 1.56 | 2.26 |
| Subscale 3: Oral Control | 4.36 | 3.52 | 1.08 | 0.91 |

**Notes:** DBS = Dieting Beliefs Scale, EAT-26 = Eating Attitudes Test. Results expressed as arithmetic mean and standard deviations.

**Table 3**
Confirmatory factor analysis of the Dieting Beliefs Scale (DBS) of all sixteen items $n = 245$.

| Factor | Indicator | Unstandardized coefficients | | | | Residual variances | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Estimate | Standard error | *Z* | *p* | Estimate | Standard error | *Z* | *p* |
| DBS | DBS1 | 0.65 | 0.07 | 8.99 | <0.001 | 0.95 | 0.09 | 10.59 | <0.001 |
| | DBS2 | 0.55 | 0.07 | 7.33 | <0.001 | 1.11 | 0.1 | 10.78 | <0.001 |
| | DBS3 | 0.89 | 0.08 | 10.76 | <0.001 | 1.15 | 0.11 | 10.25 | <0.001 |
| | DBS4 | 0.91 | 0.08 | 10.8 | <0.001 | 1.2 | 0.12 | 10.29 | <0.001 |
| | DBS5 | 1.04 | 0.1 | 10.52 | <0.001 | 1.63 | 0.16 | 10.22 | <0.001 |
| | DBS6 | 1.00 | 0.09 | 11.53 | <0.001 | 1.19 | 0.12 | 10.01 | <0.001 |
| | DBS7 | 0.99 | 0.09 | 11.64 | <0.001 | 1.15 | 0.11 | 10.07 | <0.001 |
| | DBS8 | 0.63 | 0.09 | 7.15 | <0.001 | 1.52 | 0.14 | 10.78 | <0.001 |
| | DBS9 | 0.87 | 0.08 | 10.98 | <0.001 | 1.04 | 0.1 | 10.2 | <0.001 |
| | DBS10 | 0.78 | 0.08 | 10 | <0.001 | 1.05 | 0.1 | 10.35 | <0.001 |
| | DBS11 | 0.75 | 0.08 | 9.81 | <0.001 | 1.04 | 0.1 | 10.44 | <0.001 |
| | DBS12 | 0.75 | 0.07 | 10.37 | <0.001 | 0.91 | 0.09 | 10.37 | <0.001 |
| | DBS13 | 0.86 | 0.07 | 11.83 | <0.001 | 0.83 | 0.08 | 10.07 | <0.001 |
| | DBS14 | 1.04 | 0.09 | 11.96 | <0.001 | 1.17 | 0.12 | 10.03 | <0.001 |
| | DBS15 | 0.94 | 0.08 | 12.29 | <0.001 | 0.89 | 0.09 | 9.94 | <0.001 |
| | DBS16 | 0.88 | 0.08 | 11.09 | <0.001 | 1.03 | 0.1 | 10.26 | <0.001 |

**Notes:** DBS = Dieting Belief Scale. Estimate represents factor loading, using the Maximum Likelihood Extraction algorithm (MLE). Comparative Fit Index (CFI) = 0.834, Tucker-Lewis Index (TLI) = 0.808, Bentler-Bonett Non-normed Fit Index (NNFI) = 0.808, Bentler-Bonett Normed Fit Index (NFI) = 0.786, Parsimony Normed Fit Index (PNFI) = 0.681, Bollen's Relative Fit Index (RFI) = 0.753, Bollen's Incremental Fit Index (IFI) = 0.836, Relative Noncentrality Index (RNI) = 0.834, Log-likelihood = −6052.146, Number of free parameters = 48, Akaike (AIC) = 12200.293, Bayesian (BIC) = 12368.353, Sample-size adjusted Bayesian (SSABIC) = 12216.197, Root mean square error of approximation (RMSEA) = 0.103, RMSEA p-value = 5.129 × 10–14, Standardized root mean square residual (SRMR) = 0.07, Hoelter's critical N (α = 0.05) = 85.112, Hoelter's critical N (α = 0.01) = 92.723, Goodness of fit index (GFI) = 0.955, McDonald fit index (MFI) = 0.575, Expected cross validation index (ECVI) = 1.923.

and between Factor 2 and 3 was 0.911. Additionally, the AVE for each factor exceeded 0.45, further supporting convergent validity. The AVE was 0.505 for Factor 1, 0.454 for Factor 2, and 0.560 for Factor 3. In summary, the HTMT ratios and AVE estimates provide evidence that the three factors of the Dieting Beliefs Scale are distinct and adequately capture their intended constructs in this sample. The factors demonstrate both discriminant and convergent validity based on these results. The residual variances for all indicators were statistically significant ($p < 0.001$), suggesting the latent factors did not account for all of the variance in the indicators. The indicators with the largest residual variances were DBS8 (1.67) and DBS5 (1.23). See Table 4. Few large MI were identified for potential cross-loadings. The largest was for DBS8 on Factor 1 (MI = 32.6). Other indicators with sizable cross-loadings were DBS5 on Factor 1 (MI = 13.66) and DBS6 on Factor 2 (MI = 10.53). The residual covariances with the largest MIs were between DBS13 and

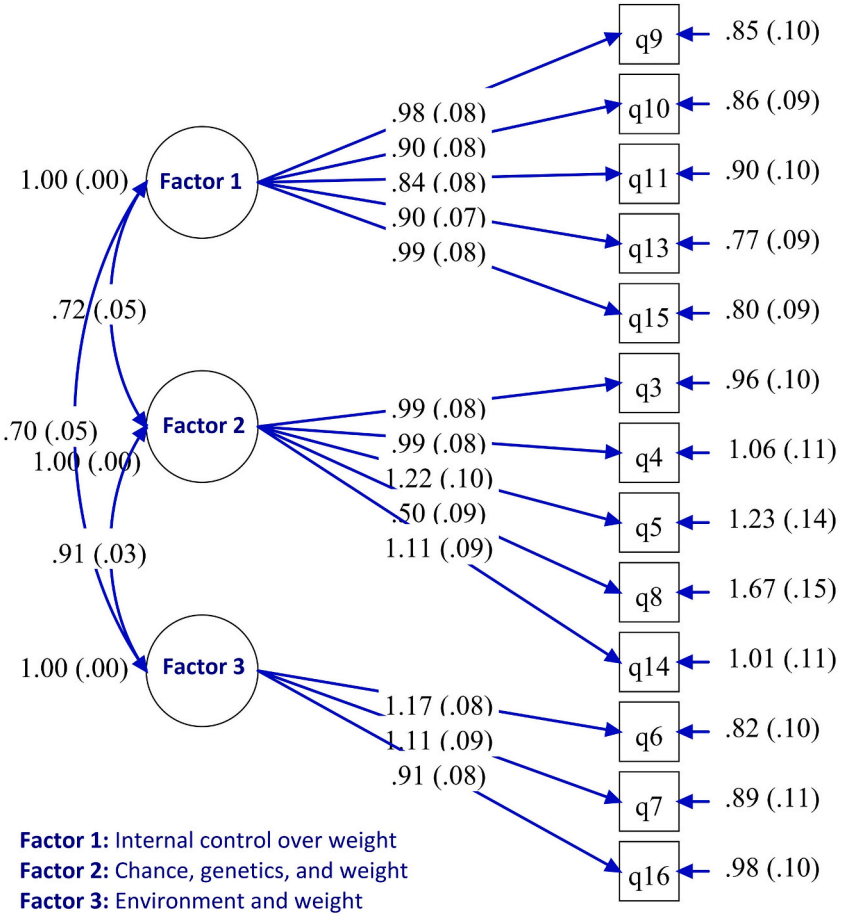


**Fig. 1.** The results of the Confirmatory Factor Analysis of the Dieting Beliefs Scale (Three-Factors) unstandardized coefficients.

**Table 4**
Confirmatory factor analysis of the Dieting Beliefs Scale (DBS) of the original version containing thirteen items $n = 245$.

| Factor | Indicator | Unstandardized coefficients | | | | Residual variances | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Estimate | Standard error | *Z* | *p* | Estimate | Standard error | *Z* | *p* |
| Factor 1 | DBS9 | 0.98 | 0.08 | 12.35 | <0.001 | 0.85 | 0.1 | 8.85 | <0.001 |
| | DBS10 | 0.90 | 0.08 | 11.53 | <0.001 | 0.86 | 0.09 | 9.17 | <0.001 |
| | DBS11 | 0.84 | 0.08 | 10.90 | <0.001 | 0.9 | 0.09 | 9.55 | <0.001 |
| | DBS13 | 0.90 | 0.07 | 12.06 | <0.001 | 0.77 | 0.09 | 9.02 | <0.001 |
| | DBS15 | 0.99 | 0.08 | 12.72 | <0.001 | 0.8 | 0.09 | 8.65 | <0.001 |
| Factor 2 | DBS3 | 0.99 | 0.08 | 12.11 | <0.001 | 0.96 | 0.1 | 9.37 | <0.001 |
| | DBS4 | 0.99 | 0.08 | 11.72 | <0.001 | 1.06 | 0.11 | 9.56 | <0.001 |
| | DBS5 | 1.22 | 0.10 | 12.76 | <0.001 | 1.23 | 0.14 | 8.94 | <0.001 |
| | DBS8 | 0.50 | 0.09 | 5.41 | <0.001 | 1.67 | 0.15 | 10.8 | <0.001 |
| | DBS14 | 1.11 | 0.09 | 12.82 | <0.001 | 1.01 | 0.11 | 9.07 | <0.001 |
| Factor 3 | DBS6 | 1.17 | 0.08 | 13.84 | <0.001 | 0.83 | 0.1 | 7.95 | <0.001 |
| | DBS7 | 1.12 | 0.09 | 13.14 | <0.001 | 0.89 | 0.11 | 8.31 | <0.001 |
| | DBS16 | 0.91 | 0.08 | 11.17 | <0.001 | 0.98 | 0.1 | 9.39 | <0.001 |

**Notes:** DBS = Dieting Belief Scale. Estimate represents factor loading, using the Maximum Likelihood Extraction algorithm (MLE). Factor 1 = internal control over weight, Factor 2 = chance, genetics, and weight, Factor 3 = environment and weight scales. Model Fitness: Comparative Fit Index (CFI) = 0.934, Tucker-Lewis Index (TLI) = 0.917, Bentler-Bonett Non-normed Fit Index (NNFI) = 0.917, Bentler-Bonett Normed Fit Index (NFI) = 0.894, Parsimony Normed Fit Index (PNFI) = 0.711, Bollen's Relative Fit Index (RFI) = 0.867, Bollen's Incremental Fit Index (IFI) = 0.935, Relative Noncentrality Index (RNI) = 0.934, Log-likelihood = −4929.17, Number of free parameters = 42, Akaike (AIC) = 9942.339, Bayesian (BIC) = 10089.392, Sample-size adjusted Bayesian (SSABIC) = 9956.255, Root mean square error of approximation (RMSEA) = 0.077, RMSEA p-value = 0.003, Standardized root mean square residual (SRMR) = 0.06, Hoelter's critical N (α = 0.05) = 132.503, Hoelter's critical N (α = 0.01) = 147.726, Goodness of fit index (GFI) = 0.983, McDonald fit index (MFI) = 0.833, Expected cross validation index (ECVI) = 0.962.

DBS14 (MI = 16.31) and between DBS10 and DBS8 (MI = 10.32).

To examine the validity of the Arabic version of the DBS scale, convergent validity was calculated by evaluating correlations between the DBS scale and the EAT-26 scale and its three subscales (dieting, bulimia, and oral control) The total DBS score demonstrated a strong positive correlation with the EAT-26 total score ($r = 0.68$, $p < 0.001$), providing evidence of convergent validity. The DBS subscales were also significantly correlated with the EAT-26 subscales that assess similar constructs. Specifically, the DBS Factor 1 (internal control over weight) was strongly correlated with the EAT-26 dieting subscale ($r = 0.51$, $p < 0.001$), the DBS Factor 2 (chance, genetics and weight) was moderately correlated with the EAT-26 bulimia and food preoccupation subscale ($r = 0.29$, $p < 0.001$), and the DBS Factor 3 (environment and weight) had the highest correlation with the EAT-26 oral control subscale ($r = 0.40$, $p < 0.001$). See Table 5.

## 4. Discussion

The current translation of the DBS into Arabic has proven to be reliable and valid in assessing locus of control for weight (internal versus external) in Arabic speakers. The mean score of the DBS scale was $M = 67.17$ ($SD = 14.22$) among the Arabic community, aligning closely with a mean of $M = 67.5$ in the original English language sample [13]. This suggests that issues related to weight control may have similar bases in many parts of the world.

The Arabic DBS scale showed acceptable internal consistency and composite reliability. Validity was demonstrated by Cronbach's α, McDonald's ω, and ICC for the DBS scale; our findings indicate a Cronbach's alpha coefficient of 0.91 for the total DBS scale. This indicates a high degree of reliability in the scale's ability to measure dieting beliefs within the Arabic-speaking population.

The CFA provided evidence for the tridimensional structure of the Arabic DBS, comprising 13 of its 16 items. The first factor contained five items that had significant factor loading (greater than 0.40), indicating that an individual can control their weight through internal factors such as willpower, effort, and the assumption of responsibility. The second factor comprises five items that have a loading above 0.40, indicative of beliefs about issues beyond personal control, such as luck, genes, and fate. In addition, the third factor contains three items, reflecting the influence of environmental factors (e.g., encouragement from others). These findings support the results of Anastaious et al. (2015), who conducted a study involving 239 adults who had experienced weight loss of a minimum of 10% and had either regained or maintained their weight loss [25]. The study reported a significant association between weight loss maintenance and internal locus of control [25].

The one-factor solution demonstrated poor fit on several indices, including the CFI (0.83), TLI (0.81), RMSEA (0.10), and statistically significant indicator residual variances. This suggests the data was not adequately represented by a single underlying construct. Contrarywise, the three-factor model showed improved global fit on the CFI (0.934), TLI (0.917), and RMSEA (0.077). The factors also evidenced good discriminant validity based on HTMT ratios below 0.90. The factors demonstrated adequate convergent validity with AVE estimates exceeding 0.45. in the three-factor structure the statistically significant residual variances indicate the presence of unexplained variance in the indicators. The modification indices also highlighted some localized strain in fit that could potentially be improved through re-specification but this was minimal.

Thus, in short, the CFA confirmed that the hypothesized factor structure fit the data well, with fit indices (CFI, TLI, RMSEA, and SRMR) meeting their respective benchmarks based on guidelines. Comparable with a unidimensional structure of the 16 item DBS, we found that this solution had a poor fit, consistent with findings by the authors of the original version of the DBS scale [13]. Interestingly, our findings on convergent validity revealed a significant correlation between the DBS scale and the EAT-26 questionnaire. This finding indicates a meaningful association between beliefs related to locus of control with respect to weight and symptoms associated with eating disorders. The positive correlation suggests that individuals who believe they have little control over their weight present a relatively higher risk for eating disorders than those who believe that they are capable of controlling their own weight.

The present findings align with prior research demonstrating the multidimensional structure of the DBS across cultural contexts. For instance, the original English DBS validation found support for a three-factor model distinguishing internal control, external control by chance happenings, and external control by powerful others [13]. Our CFA replicated this underlying factor structure within an Arabic population, providing cross-cultural validation of the DBS framework. These results suggest that differentiating control

**Table 5**
Intercorrelations of the Dieting Beliefs Scale (DBS) and Eating Attitudes Test-26 (EAT-26) and their subscales $n = 245$.

| | DBS | DBS-F1 | DBS-F2 | DBS-F3 | EAT-26 Total | EAT-26-F1 | EAT-26-F2 | EAT-26-F3 |
|---|---|---|---|---|---|---|---|---|
| DBS | – | | | | | | | |
| DBS-F1 | 0.87*** | – | | | | | | |
| DBS-F2 | 0.89*** | 0.63*** | – | | | | | |
| DBS-F3 | 0.83*** | 0.57*** | 0.72*** | – | | | | |
| EAT-26 | 0.68*** | 0.54*** | 0.64*** | 0.61*** | – | | | |
| EAT-26-F1 | 0.62*** | 0.51*** | 0.59*** | 0.55*** | 0.88*** | – | | |
| EAT-26-F2 | 0.27*** | 0.19*** | 0.29*** | 0.23*** | 0.48*** | 0.18*** | – | |
| EAT-26-F3 | 0.41*** | 0.32*** | 0.36*** | 0.40*** | 0.61*** | 0.27*** | 0.16*** | – |

**Notes:** *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. DBS = Total Dieting Belief Scale (DBS), DBS-F1 = Internal control over weight, DBS-F2 = Chance, genetics, and weight, DBS-F3 = Environment and weight scales, EAT-26 = Total Eating Attitudes Test-26, EAT-26-F1 = Dieting, EAT-26-F2 = Bulimia and Food Preoccupation, EAT-26-F3 = Oral Control.

attributions along personal responsibility, chance, and social influence dimensions has relevance, perhaps transculturally, for a healthy control of weight.

It should be acknowledged that a strongly expressed belief in an external locus of control may be an indicator of psychological distress and that there exists a bidirectional relationship between weight loss and psychological well-being. In a recent study involving 96 subjects with obesity aged 18 years and over, Zhu et al. (2021) reported that low levels of psychological well-being along some dimensions are associated with poor outcomes of a weight loss odds ratio = 0.83 [95% CI: 0.70, 0.98] [26]. It may, therefore, be the case that a DBS indication of external locus of control for weight predicts poor adherence to dietary measures because of psychological distress. Understanding the association between psychological well-being and maintenance of weight loss has implications for the treatment of both conditions.

The translation and validation of the Arabic DBS carries important theoretical and practical implications. Theoretically, support for the scale's reliability and validity within a new cultural context expands locus of control theory as a useful lens for examining the roots of disordered eating globally. Practically, translating and validating this instrument addresses a need for reliable and valid instruments tailored to Arabic-speaking communities, providing clinicians and researchers an empirically-supported tool to prevent eating disorders or to intervene early in their effective treatment. Early screening with the Arabic DBS can inform culturally-sensitive prevention and treatment approaches targeting dysfunctional weight and diet beliefs in this population.

### *4.1. Limitations and strengths*

This translation and validation of the DBS scale has several limitations. The first is using social media and instant messaging applications as a tool for convenience sampling. This sampling method may have led to selection bias, and as a result, the generalizability of the findings is limited to a relatively young population who utilizes these social forums. The second limitation is response and social desirability bias, which may accompany the use of self-reported measures. The third is the sample size, which placed constraints on the ability to detect potential problems with the questionnaire. Lastly, due to the sample size and the requirement for expertise in Multidimensional Item Response Theory (MIRT), we were unable to perform IRT analyses in this study [27]. However, future research with larger sample sizes and specialized statistical knowledge should consider incorporating IRT to further investigate the psychometric properties of the DBS. Integrating IRT would provide a more nuanced understanding of item characteristics and enhance the scale's measurement precision in assessing dieting beliefs.

Despite these limitations, the translation and validation of the DBS questionnaire also has strengths. First, this is the first attempt to translate and evaluate a reliable tool to assess the weight locus of control in Arab societies. Second, a rigorous translation procedure was applied, and the accuracy of the questionnaire and cultural appropriateness were also ensured by following best practices. Lastly, conducting comprehensive psychometric evaluations, including internal consistency, convergent validity, test-retest reliability, and CFA, resulted in solid evidence for the dependability and validity of the Arabic version of the DBS.

## 5. Conclusion

The translation and validation of the DBS into Arabic have significantly advanced research on problematic eating cognitions in Arabic-speaking populations. The results of psychometric testing in this study demonstrate that the Arabic version of the DBS is a valid and reliable tool for assessing dysfunctional dieting attitudes and locus of control beliefs pertaining to weight within the Arabic cultural context. The DBS scale exhibited strong internal consistency, test-retest reliability, and convergent validity with the EAT-26. Its robust performance across multiple assessments of reliability and validity indicates its suitability for effectively measuring maladaptive dieting ideations that may contribute to eating disorder risk in the population studied. The successful development of this DBS version provides clinicians and researchers with a valuable resource for understanding harmful thought patterns related to diet, weight, and body image in diverse Arabic populations.

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## Ethical approval/institutional review board statement

The Institutional Review Board at the University of El Kef, Tunisia (047–2023) in conformity with the fundamental ethical standards for research involving human beings outlined in the Declaration of Helsinki.

## Informed consent statement

Informed consent was obtained from all subjects involved in the study. All participants were adults (over 18 years of age).

## Data availability statement

Derived data (and analysis codes) supporting the findings of this review are available from the corresponding author (HJ) based on request without any questioning.

## CRediT authorship contribution statement

**Salma Yasser Abu-Saleh:** Writing – review & editing, Writing – original draft. **Wajiha Irsheid:** Writing – review & editing, Writing – original draft. **Hadeel Ghazzawi:** Writing – review & editing, Validation, Supervision, Investigation. **Adam Tawfiq Amawi:** Supervision, Validation. **Seithikurippu R. Pandi-Perumal:** Writing – original draft, Writing – review & editing. **Khaled Trabelsi:** Investigation, Supervision, Writing – review & editing. **Mary V. Seeman:** Writing – original draft, Writing – review & editing. **Haitham Jahrami:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Formal analysis.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e28842.

## References

[1] H.A. Ghazzawi, et al., The global prevalence of screen-based disordered eating and associated risk factors among high school students: systematic review, meta-analysis, and meta-regression, J Eat Disord 11 (1) (2023) 128.
[2] O.A. Alhaj, et al., The prevalence and risk factors of screen-based disordered eating among university students: a global systematic review, meta-analysis, and meta-regression, Eat. Weight Disord. 27 (8) (2022) 3215–3243.
[3] A. Jill Thompson, S. Poyrazli, E. Miller, Western media and body image dissatisfaction in young women in developing nations. Eurasian journal of educational research 90 (2020) 45–66.
[4] B.M. Popkin, S.W. Ng, The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable, Obes. Rev. 23 (1) (2022) e13366.
[5] R.F. Rodgers, et al., Body image as a global mental health concern, Glob Ment Health (Camb) 10 (2023) e9.
[6] M. Badran, I. Laher, Obesity in Arabic-speaking countries, Journal of obesity (2011) 2011.
[7] S. Barakat, et al., Risk factors for eating disorders: findings from a rapid review, J Eat Disord 11 (1) (2023) 8.
[8] C. Cheng, et al., Cultural meaning of perceived control: a meta-analysis of locus of control and psychological symptoms across 18 cultural regions, Psychol. Bull. 139 (1) (2013) 152.
[9] B.M. Galvin, et al., Changing the focus of locus (of control): a targeted review of the locus of control literature and agenda for future research. Journal of Organizational Behavior 39 (7) (2018) 820–833.
[10] S.A. Varady, Perceived Control, Religious Belief, and the Eating Disorders, George Mason University, 2002.
[11] R. Eiber, C. Mirabel-Sarron, I. Urdapilleta, [Cognitions in eating disorders and their assessment]. Encephale 31 (6 Pt 1) (2005) 643–652.
[12] G. Castellini, et al., Bridging cognitive, phenomenological and psychodynamic approaches to eating disorders. Eating and Weight Disorders - studies on Anorexia, Bulimia and Obesity 27 (7) (2022) 2273–2289.
[13] S. Stotland, D.C. Zuroff, A new measure of weight locus of control: the Dieting Beliefs Scale. Journal of personality assessment 54 (1–2) (1990) 191–203.
[14] D.E. Beaton, et al., Guidelines for the process of cross-cultural adaptation of self-report measures, Spine 25 (24) (2000) 3186–3191.
[15] E.J. Wolf, et al., Sample size requirements for structural equation models: an evaluation of power, bias, and solution propriety, Educ. Psychol. Meas. 76 (6) (2013) 913–934.
[16] D.M. Garner, et al., The eating attitudes test: psychometric features and clinical correlates, Psychol. Med. 12 (4) (1982) 871–878.
[17] T.M. Torres-McGehee, et al., Body image, anthropometric measures, and eating-disorder prevalence in auxiliary unit members. Journal of athletic training 44 (4) (2009) 418–426.
[18] S. Al-Adawi, et al., A survey of anorexia nervosa using the Arabic version of the EAT-26 and "gold standard" interviews among Omani adolescents. Eat Weight Disord 7 (4) (2002) 304–311.
[19] N. Shrestha, Factor analysis as a tool for survey analysis. American journal of applied mathematics and statistics 9 (1) (2021) 4–11.
[20] Y. Rosseel, lavaan: an R package for structural equation modeling. Journal of statistical software 48 (2012) 1–36.
[21] R.B. Kline, publications Guilford. Principles and practice of structural equation modeling, 2023, pp. 156–179.
[22] R. Kline, Response to leslie Hayduk's review of principles and practice of structural equation modeling, 4th edition, Can. Stud. Popul. 45 (2018) 188.
[23] L.t. Hu, P.M. Bentler, Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives, Struct. Equ. Model.: A Multidiscip. J. 6 (1) (1999) 1–55.
[24] L.-T. Hu, P.M. Bentler, Evaluating model fit, in: R.H. Hoyle (Ed.), Structural equation modeling: Concepts, issues, and applications, Sage Publications, Inc, CA, USA, 1995, pp. 76–99.
[25] C.A. Anastasiou, et al., Weight loss maintenance in relation to locus of control: the MedWeight study, Behav. Res. Ther. 71 (2015) 40–44.
[26] B. Zhu, et al., The role of psychological well-being in weight loss: new insights from a comprehensive lifestyle intervention. International Journal of Clinical and Health Psychology 22 (1) (2022) 100279.
[27] C. Zanon, et al., An application of item response theory to psychological test development, Psicol. Reflexão Crítica 29 (1) (2016) 18.