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Development of the two-factor modified Kids Eating Disorder Survey (M-KEDS): a validation study with hispanic adolescents

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Abstract

Background Disordered eating behaviors and body dissatisfaction are highly prevalent among adolescents and linked to negative health outcomes. While Hispanic adolescents appear to be at high risk of disordered eating and body dissatisfaction, validated tools for assessment of these health concerns among this population are lacking.

Methods This study used Confirmatory Factor Analysis to establish factorial validity for the Kids Eating Disorder Survey (KEDS) among a community sample of Hispanic adolescents. Internal consistency was measured by the Kuder-Richardson Formula 20 (KR-20).

Results Participants ($N = 690$) were Hispanic (100%) and female (53%), with a mean age of 12 years. After testing the psychometric properties of KEDS and implementing modifications, the resulting two-factor KEDS model (M-KEDS) showed acceptable fit (TLI = 0.98, CFI = 0.99, RMSEA = 0.06) for the Weight Dissatisfaction (renamed to Negative Weight Attitudes) and Purging/Restriction (renamed to Extreme Weight Control Behaviors) sub-scales and good internal consistency (KR-20 = 0.77).

Conclusion M-KEDS is a factorial valid instrument for assessing Extreme Weight Control Behaviors and Negative Weight Attitudes among Hispanic adolescents. Hispanics are among the fastest-growing racial/ethnic groups in the United States, warranting further research on negative weight attitudes and extreme weight control behaviors in this population.

Background

Disordered eating behaviors are associated with depression, suicidality, substance abuse, and other serious physical, psychological, and social consequences [1–6]. Examples of behaviors include binge eating, restrictive eating, and purging behaviors (i.e., self-induced vomiting, laxative and diuretic abuse, and extreme exercise) [7, 8]. Estimates from diverse community samples suggest that up to 50% of adolescent girls and 30% of adolescent boys engage in disordered eating behaviors, [9] with recent population-based data indicating that preadolescents (aged 10-11 years) are also at risk for disordered eating behaviors, particularly binge eating disorder [10, 11]. Body dissatisfaction, defined as

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negative self-appraisals of one's shape and/or weight, [11] is a well-established risk factor for disordered eating behaviors and clinically diagnosed eating disorders in adolescents [2, 4, 12–16]. Body dissatisfaction is also highly common among adolescents, as nearly one-fourth of adolescents (aged 12-17) report body dissatisfaction [17]. The prevalence of body dissatisfaction and disordered eating behaviors varies across ethnic groups in the United States. When comparing prevalence rates of disordered eating between ethnic groups in large community samples, Hispanic Americans appear to be at high risk. For instance, in a nationally representative sample of 10,123 adolescents (ages 13-17), Hispanic American adolescents had the highest prevalence of bulimia nervosa and binge eating disorder of all ethnic groups [18] and were more likely to report distress while engaging in binge eating behaviors relative to other racial/ethnic groups [19]. Body dissatisfaction also appears to be common among Hispanic American adolescents (ages 11-20) and is highly correlated with the development of disordered eating behaviors in this population [20].

The Kids' Eating Disorder Survey (KEDS) is a 14-item self-report screening tool assessing weight dissatisfaction and purging/restriction behaviors [21]. The KEDS was originally validated among 5th-8th graders (ages 10-13, 64.2% White, 21.5% Black, and 6.8% "other") in South Carolina in 1993. When the KEDS was developed, the KEDS met a need for a validated disordered eating screening tool that assessed unhealthy weight control behaviors (such as diet pills or laxative use) in this age group [21]. The original psychometric properties of the KEDS show a strong internal consistency (Cronbach's α: 0.73) and high test-retest reliability ($r=0.83$) [21]. The KEDS contains two subscales: Weight Dissatisfaction and Purging/Restriction [21]. The Weight Dissatisfaction subscale includes two items that assess binge eating behaviors and an assessment of body dissatisfaction using Child Figure Drawings [21]. The Purging/Restriction subscale includes an assessment of unhealthy weight control behaviors such as vomiting, fasting, diet pills, diuretics, and laxative use. The KEDS is currently only validated in a sample of primarily white adolescents aged 10-13. The KEDS is not currently validated in different ethnic groups.

Despite this limited validity, it is recommended by the American Academy of Child and Adolescent Psychiatry as a screening instrument in children and adolescents for eating disorders [22], and is currently being used in multiple studies [23–33], including among community samples of primarily Hispanic American adolescents [30–33]. Given the lack of validity among Hispanic populations, the use of this instrument could lead to missed or inappropriate diagnoses of eating disorders in both research and practice.

Although Hispanic American adolescents are at high risk for disordered eating, this population still lacks consistent measures for body dissatisfaction and disordered eating [31, 32, 34–39]. Several disordered eating assessment tools are used among similar populations, such as Hispanic/Latino and Puerto Rican emerging adults and Mexican adolescents. Yet, there are inconsistent findings regarding the validity of the tools for each population. For example, the modified 7-item, 3-factor structure version of the Eating Disorder Examination – Questionnaire is validated among Hispanic adults (mean age = 20.11 years) [40] and Latina college students (mean age = 19 years), [41] yet the 22-item, 2-factor model appears to be a better fit for adolescents from Mexico (mean age = 15.1 years) [42]. Other tools, such as the Eating Attitudes Test-40, validated among older Mexican adolescents with a mean age of 19.3, [43] and the Eating Attitudes Test-26, used among Puerto Rican college students, [44] are also not validated in younger Hispanic adolescents. Taken together, there is a lack of reliable, validated, brief, and easily utilized disordered eating screening measures suitable for younger age groups. The use of such screening tools may not be comparable across different racial/ethnic identifications and geographic locations. Clinically significant disordered eating behaviors can emerge in preadolescence and early adolescence, [10, 45, 46] making it imperative that appropriate screening mechanisms consider younger populations across racial/ethnic groups.

Given the gap in the literature regarding validated screening tools among Hispanic American adolescents (age 10-13) and the broad use of the KEDS, including the recommended use of the KEDS as an eating disorder screener for children and adolescents, [22] the use in randomized clinical interventions [23] and in school settings, [30, 31, 33, 47] it is important to understand whether the original factor structure of the KEDS is appropriate among this population. This study aims to establish factorial validity of the psychometric properties of the KEDS in Hispanic American adolescents. We hypothesize the original factor structure of the KEDS would be suitable for Hispanic American adolescents, given the previous use of the KEDS in clinical and community settings, including this group. Assessing the validity of the KEDS among Hispanic American adolescents is an essential step towards improving our understanding of how body dissatisfaction relates to disordered eating in this high-risk population and could have clinical implications for prevention and treatment.

Materials and methods

Study overview

Participants

Data for the present study were drawn from baseline data collection of the school-based Family Lifestyle Overweight Prevention Program (FLOW) intervention [48–50]. In the FLOW intervention, Hispanic adolescents in a public charter school were recruited and consented into a class focused on healthy lifestyles during their physical education class period. Child and parent assent was obtained, and all children were eligible to participate regardless of weight. The intervention included randomization into an instructor-led intervention or a self-help condition during their last class period for 12 weeks. The recruitment, randomization procedures, and sample characteristics of this study have been previously described elsewhere [51]. Only baseline data was used in this secondary data analysis. The initial sample of 1551 adolescents was reduced to only include participants who completed the KEDs in full at baseline (n = 859 eliminated) and had complete gender data (n = 2 eliminated). The final analytical sample for the present study includes 690 adolescents. BMI percentiles were calculated based on gender-specific BMI–for–age percentiles for children aged 2-19 [52, 53]. To calculate BMI percentile, BMI is calculated using body weight (in kilograms) divided by the square of their height (in meters). The BMI is then plotted on a gender-appropriate growth chart by age to identify the child's BMI percentile. One-way univariate analyses of variance tests were utilized to compare demographic characteristics, including age, sex, and BMI percentile, between excluded individuals from those included in the analytical sample. Baylor University's Institutional Review Board approved the study, all parents provided written consent, and adolescents provided written assent prior to enrollment into the study.

KEDS

The KEDS measures two subscales: Weight dissatisfaction and purging/restriction behaviors [21]. The two components correspond with 14 items. Possible responses include "yes"=2, "no"=0, or "?"=1 [21]. The Weight Dissatisfaction component included nine items: a desire to lose weight now, felt looked fat to others, dieted to lose weight, exercised a lot to lose weight, afraid to eat because of weight gain, frequent binge eating (2 items), and body dissatisfaction (2 items) [21]. The Purging/Restricting component included five items: used diet pills, used diuretics, used laxatives, vomited to lose weight, and fasted to lose weight [21]. Frequent binge eating was assessed with two items as part of the Weight Dissatisfaction component. First, respondents are asked to choose a response that represented the largest amount of food they had ever consumed within two hours from six examples of progressively increasing quantities of food (e.g., two doughnuts, a cup of ice cream, and two cookies; six doughnuts, a quart of ice cream and ten cookies; and eight doughnuts, a half-gallon of ice cream, and fifteen cookies) [21]. Response options were scored from 1 (smallest) to 6 (largest), representing each quantity of food. Second, the participants are asked to choose a response that represents how many times they have eaten the amount of food selected in the previous question [21]. Response options were scored from 1 or 2 times only (smallest) to more than 50 times (largest), representing the number of times. Two items assessed body dissatisfaction, which was part of the Weight Dissatisfaction component, using body image silhouettes, also referred to as Child Figure Drawings (CFD) [21]. For the CFD, adolescents were instructed to circle their perceived "actual" figure and to underline their preferred "ideal" figure. The body dissatisfaction score was scored as the difference between the ideal and actual figures (scores <2 = 0; score of 3 = 1; score of >4 = 2) [21].

Statistical analysis

All analyses were performed using Mplus (Version 8) [54]. Confirmatory Factor Analysis (CFA) was used to provide a confirmatory test of the original KEDS factor structure. Three models were tested: the original KEDS with a two-factor structure (Weight Dissatisfaction and Purging/Restriction), a one-factor KEDS structure, and the modified KEDS with a two-factor structure (M-KEDS) (Negative Weight Attitudes and Disordered Eating Behaviors). The first model tested was based on the original KEDS [21]. A unidimensional model was tested to provide information regarding the factorial validity of the original measurement theory [55]. The final model was the M-KEDS. The M-KEDS modifications were based on the results from the original KEDS factor structure and the unidimensional models. All models were estimated using robust weighted least squares (WLSMV) estimation; this estimator accommodates dichotomous data and provides robust standard errors and adjusted test statistics [56]. Since observations of a variable were missing completely at random, the listwise deletion method was utilized, which is known to produce unbiased estimates and conservative results for handling missing data [57, 58]. Internal consistency was evaluated using the Kuder-Richardson Formula (KR-20), the preferred reliability measurement for a test with binary variables, and the scores range from 0 to 1. The formula is shown in Table 1. A KR-20 coefficient is a non-parametric equivalent to Cronbach's alpha, ≥ 0.70 indicates the measure is internally consistent [59]. The original KEDS two-factor, one-factor, and the M-KEDS

Table 1 Kuder-Richardson Formula (KR-20)

$$\rho_{KR20} = \frac{k}{k-1}\left(1 - \frac{\sum_{j=1}^{k} p_j q_j}{\sigma^2}\right)$$

k = number of questions

pj = number of people in the sample who answered question j correctly

qj = number of people in the sample who didn't answer question j correctly

σ2 = variance of the total scores of all the people taking the test = VAR.P(R1) where R1 = array containing the total scores of all the people taking the test

Table 2 Sample characteristics (*N* = 690)

Variable		N	%
Sample Size, n		690	
Sex	Male	327	47%
	Female	363	53%
Age, years	9 - 10	5	1%
	11	366	53%
	12	263	38%
	13-14	56	8%
BMI Percentile	< 5^{th}	10	1%
	5^{th} – 85^{th}	346	50%
	85^{th} – 95^{th}	115	17%
	>95^{th}	219	32%

modified two-factor models were tested. Evaluation of global model fit was based on the model chi-square statistic, Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA) [60]. All models were evaluated with the Tucker-Lewis Index (TLI) to account for the sample size since it is relatively unaffected by sample size [60–62]. The following cutoff criteria values were used: CFI > 0.95, TLI > 0.95, and RMSEA < 0.06 for an acceptable model fit [60]. All results were screened for negative variance estimates, out-of-range standardized loadings, and significant standardized residuals to assess local model misfit.

Results

Sample characteristics

The final analytical sample for the present study includes 690 adolescents, ages 9 to 14 years. Sample characteristics are shown in Table 2. On average, participants were 12 years old (SD± 0.7), in the 6th or 7th grade, and a BMI of 22.8 kg/m2 (SD ± 8.5; Range 11.34-52.47). Sample characteristics are shown in Table 2. The prevalence of obesity was higher than the national average in this sample [63]. All participants self-identified as Hispanic. Ninety-five percent of adolescents self-identified as Mexican American, and five percent self-identified as other. There were no significant differences between genders regarding BMI or BMI percentile ($p > 0.05$). One-way univariate analyses of variance tests showed no differences ($p > 0.05$) on demographic characteristics, age, BMI, and BMI percentile, between excluded individuals and those included in the analytical sample ($p < 0.05$).

Models tested

Original two-factor KEDS

The original two-factor KEDS model specified items as continuous indicators. The observed frequency of "not sure" or "?" responses for the first ten items was 0.3-3.5% of responses. Due to the low response rate, items 1-10 were transformed into dichotomous indicators. All responses of yes received a score of 1, while responses of "no" or "not sure" were given a score of zero. While this model was internally consistent (KR-20 = 0.67), the model was not supported due to negative variance estimates and out-of-range standardized loadings, otherwise known as Heywood Cases [60].

One-factor KEDS model

The second model, the One-Factor KEDS, also fit the data well. However, this model had reasonably strong floor effects (i.e., 90% to 99% of the cell counts were "no"). Upon further examination of the items, it was determined disordered eating behavior items 5 (fasting), 6 (vomiting), 8 (diet pill use), 9 (diuretics), and 10 (laxatives) demonstrated reasonably strong floor effects, which produced model estimation problems. The low response rates for these items are consistent with the prevalence of disordered eating behavior in adolescents; when the items were merged, it reflected that 13% of participants reported at least one of these five behaviors. The items were collapsed into one dichotomous item (yes on at least one disordered eating behavior = 1; no or "not sure" on these items = 0), and the KEDS was tested again with a unidimensional factor structure. Table 3 shows the descriptive statistics of the dichotomous items. Combining these items aligns with this study's objective of validating a disordered eating behavior and body dissatisfaction screening measure for Hispanic adolescents. With this change, the model was internally consistent (KR-20 = 0 .69) but failed to improve the overall model fit.

Modified two-factor KEDS – M-KEDS

Additional modifications were made to improve the model fit. The original two-factor KEDs by Childress et al. were validated with principle component analysis; however, the frequency of binge eating failed to load [21].

Table 3 Descriptive statistics of dichotomous items of the 12-item M-KEDs (*N* = 690)

	Item	Item #	Yes responses N (%)
Negative weight attitudes	Do you want to lose weight now?	1	415 (60)
	Have you ever thought that you looked fat to other people?	2	301 (44)
	Have you ever been afraid to eat because you thought you would gain weight?	3	200 (29)
	Body Dissatisfaction	11 (actual) 12 (ideal)	505 (73)
Extreme Weight Control Behaviors	Have you ever tried to lose weight by dieting? (dieting means eating at least some food, but less than you usually eat.)	4	250 (36)
	Have you ever exercised a lot to lose weight? (a lot means more than one hour every day.)	7	265 (38)
	Have you ever tried to lose weight by fasting? Have you ever made yourself throw up (vomit)to lose weight? Have you ever taken diet pills to lose weight? Have you ever taken diuretics to lose weight? Have you ever taken water pills to lose weight? Have you ever taken laxatives to lose weight?	5, 6, 8-10[a]	88 (13)
M-KEDs		1-12[b]	**(KR-20=0.77)**

KR-20: The Kuder-Richardson Coefficient of reliability is a non-parametric equivalent to Cronbach's alpha

[a] Items 5, 6, 8-10 were responded to individually, but responses were merged so that 13% of participants reported at least one of these five behaviors

[b] Original KEDS included two binge-eating items (13 & 14) that were dropped on M-KEDS

The authors cited that these young participants had difficulty understanding the examples with specific foods and frequencies. The current study identified the same problem: the binge eating items were not significantly correlated with any other items (*p values >0.05*). The binge eating assessment was subsequently dropped due to a lack of improvement in this measure.

The final model, the M-KEDS included seven items and two subscales, body dissatisfaction and disordered eating subscales were highly correlated (r = 0.58-0.74 in this sample). Figure 1 illustrates the modifications made to the Original two-factor KEDS based on the results of the CFA to develop the M-KEDS.

In contrast to the original validation analysis of the two-factor KEDS [21], the present study found body dissatisfaction assessment using body silhouettes loaded significantly on the Weight Dissatisfaction component (*p<0.001*). This item was originally scored such that a

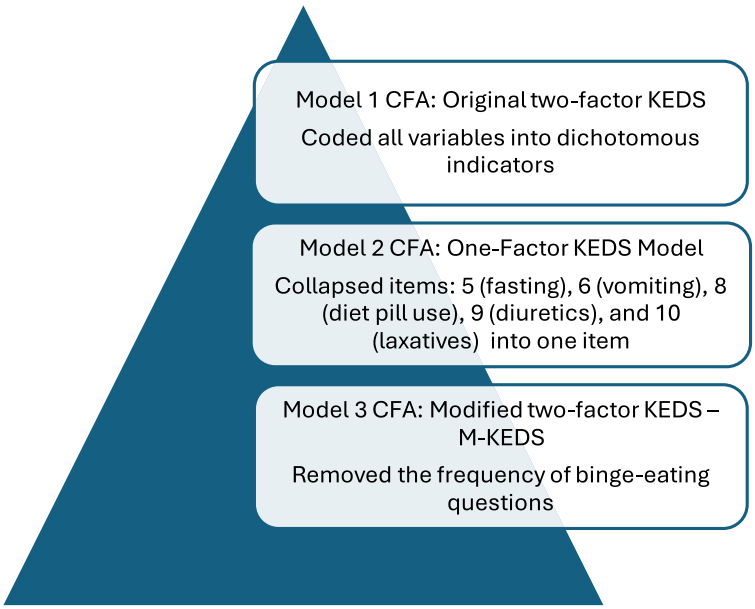

Fig. 1 Validation schematic: modifications based on the confirmatory factor analysis

difference of two or more silhouettes between ideal and actual body size indicated body dissatisfaction [21]; however, other studies utilizing body image silhouettes (i.e., CFD) score any discrepancy between actual and ideal body sizes [32, 34, 36, 64–66]. This item was rescored to be consistent with other literature utilizing the CFD, such that body dissatisfaction reflects any difference between actual and ideal body size, with no difference between the selected actual and ideal body size yielding a score of zero.

Purging/restricting behavior items: 5 (fasting), 6 (vomiting), 8 (diet pill use), 9 (diuretics), and 10 (laxatives) demonstrated reasonably strong floor effects, and these items were collapsed into one dichotomous item, with one score indicating whether the respondent endorsed one or more of these behaviors or none. After these modifications were made, the authors renamed the factors Negative Weight Attitudes and Extreme Weight Control Behaviors to reflect the measured constructs better. Table 3 shows the descriptive statistics for dichotomous items of the M-KEDS. Table 4 depicts the Pearson correlation matrix for the items of the M-KEDS.

The model goodness of fit statistics for the original two-factor KEDS, one-factor KEDS, and modified two-factor M-KEDS are presented in Table 5. After testing the psychometric properties of the KEDS, the original two-factor KEDS had good model fit but was not tenable due to the Heywood cases. After implementing the modifications described above, minor improvements were made to the model fit, and the internal consistency improved. The M-KEDS demonstrated an adequate fit to the data and improved internal consistency. Although the M-KEDs two-factor model chi-square test is statistically significant (p = <0.0001), its other model fit indices (e.g., CFI = 0.99, TLI = 0.98, RMSEA = 0.06, 90% C.I.: 0.04, 0.08), indicate the model fit is acceptable. Given the sample size, less weight was given to the significance of the model chi-square test and more to the TLI. The M-KEDS parameter estimates are shown in Table 5. The M-KEDs demonstrated good internal consistency with KR-20=0.77, resulting in an improved internal consistency compared to the original two-factor KEDS for Hispanic American adolescents [21].

Discussion

This study aimed to establish factorial validity of the KEDS in Hispanic-American adolescents. Contrary to our hypothesis, the KEDS's original factor structure was unsuitable for the Hispanic-American adolescents in this study sample. After testing the psychometric properties of the original KEDS, several modifications were needed. The resulting modified two-factor Kids Eating Disorder Survey (M-KEDS) provides a better fit for the data in this population. This finding is consistent with prior research among Hispanic populations, which indicates that the utility of screening tools varies by factors including age and ethnicity [40, 42]. As such, the application of screening tools in diverse communities may require additional cross-validation analyses and testing of psychometric properties. The present study found the M-KEDS has

Table 4 Pearson correlation matrix used for the M-KEDs CFA in Hispanic adolescents ($N = 690$)

Item (#)	1	2	3	11/12	4	7
Lose weight (1)						
Felt Looked fat (2)	.51*					
Afraid to eat (3)	.32*	.39*				
Body dissatisfaction (11/12)	.45*	.33*	.26*			
Dieting (4)	.48*	.40*	.37*	.26*		
Exercised a lot (7)	.42*	.28*	.15*	.20*	.38*	
Fasting, vomiting, diet pills, diuretics, water pills, laxatives (5, 6, 8-10)	.24*	.22*	.33*	.15*	.32*	.25*

* $P < 0.001$

Table 5 Goodness of fit statistics for tested models for the KEDS in Hispanic adolescents ($N = 690$)

Model	χ^2	DF	NFParm	CFI	TLI	RMSEA [90% CI]
Original KEDs Two-Factor CFA	88.617	53	27	.98	.98	.031 [.019, .042]
One-Factor CFA	73.853	20	18	.97	.96	.062 [.048,.078]
M-KEDS Two-Factor CFA	46.992	13	15	.99	.98	.062 [.043, .081]

CFA Confirmatory factor analysis, *CFI* Comparative fit index, *TLI* Tucker–Lewis index, *RMSEA* Root mean squared error of approximation, *NFParm* Number of free parameters

factorial validity and is a brief and easily utilized screening instrument to assess for Negative Weight Attitudes and Extreme Weight Control behaviors in Hispanic adolescents, making the M-KEDS a potentially useful tool for screening and prevention in this high-risk population.

Although the KEDs has been widely used and recommended, there has yet to be any agreement by researchers on how to deal with the two items that did not statically load in the original KEDs, frequent binge eating and body image. The findings from the current study provide additional evidence that the original KEDs two-factor model does not adequately capture the factor structure of the KEDs due to local misfits and uninterpretable out-of-range parameter estimates. Initial testing of the original two-factor KEDS indicated adolescents had difficulty understanding the binge eating items, specifically, the quantities of food and frequencies of consumption listed [21]. To address this, other researchers have utilized interviews and food models [24]. Dalton et al. chose to remove these items when calculating the scale in a sample of Hispanic adolescents [30, 67]. Others have chosen to use the scale with the items included. Because the binge eating items are not included in the M-KEDS, the M-KEDS is not suitable for the assessment of binge eating in this population. Hispanic adolescents are at the highest risk among all ethnic groups to report binge eating, making screening particularly important for this population, [18, 68, 69] and future research is needed to uncover better ways to assess binge eating among Hispanic adolescents. Assessment of binge eating could be complicated by individual differences in understanding heterogeneous definitions and heterogeneous assessments of binge eating [70]. Previous qualitative research aiming to uncover how adolescents understand binge eating showed definitions varied among factors such as loss of control, types of food consumed, and the potential interacting roles of emotions, hunger, restriction, and purging [70]. This is consistent with evidence-based practice in the treatment of binge eating in adolescents and children [22]. There is also variation in how binge eating is assessed in the literature with regard to portion sizes, speed of eating, emotions such as embarrassment or guilt, and physical discomfort [71]. Adolescents in various stages of development may have difficulty answering questions pertaining to these factors, as they rely on subjective experience and retrospective recall [1]. Further, binge eating is thought to exist on a continuum, adding to the complexity of its assessment [72]. While the original binge eating assessment in the two-factor KEDS did not seem to capture binge eating behaviors adequately, the relationship between binge eating with weight gain, body dissatisfaction, and psychosocial health and its tendency to track into adulthood highlights binge eating as an important public health concern [2, 14, 16, 73, 74]. To better inform how binge eating can be precisely measured in the literature, future research should consider how we can improve our understanding of adolescent perceptions of binge eating and relevant factors that might be of influence, such as culture, age, media, body image, and weight.

The present study provided evidence the M-KEDS has factorial validity for assessing body dissatisfaction among Hispanic adolescents in a disordered eating screening tool. The M-KEDS assessment of body dissatisfaction as part of the Negative Weight Attitudes component could aid future research in clarifying how body dissatisfaction relates to extreme weight control among Hispanic adolescents. For example, some previous research indicates body dissatisfaction is highly prevalent among Hispanic female adolescents, [9] while others suggest body dissatisfaction rates do not vary by ethnic group [75]. These mixed findings could be due to several factors, such as inconsistency in the operational definition of body dissatisfaction among Hispanic adolescents across studies [36, 75] and additional variables that may explain variations in body dissatisfaction in this population. Previous research in this area suggests that Hispanic adolescents could be vulnerable to factors influencing body dissatisfaction, such as acculturation, family relationships, and internalization of the thin ideal [76–78]. Although understanding the influences unique to the development of body dissatisfaction among Hispanic adolescents is beyond the scope of this study, given the strong relationships between body dissatisfaction, disordered eating behaviors, and other negative health outcomes, [2, 4, 6, 12, 13, 15, 16, 68, 79] further analysis of body dissatisfaction among Hispanic American adolescents is warranted. The M-KEDS provides an opportunity to examine body dissatisfaction as it relates to extreme weight control behaviors in this population.

Strengths and limitations

The M-KEDS has factorial validity and is a brief screening instrument for Negative Weight Attitudes and Extreme Weight Control Behaviors among Hispanic adolescents. The M-KEDS may not be generalizable to other populations. The development of the M-KEDS addresses a critical gap in the literature regarding screening tools in this population and contributes to the foundation of future research in this area. It is important to note this initial factorial validation of the M-KEDS was based on self-report data from a community sample of adolescents from Houston, Texas. Further analyses and cross-validation of the M-KEDS with similar populations will improve our understanding of the factorial structure of the M-KEDS. Future research should assess concurrent

validity. The additional analyses of the M-KEDS should consider the recoding items so response options of "no" and "not sure" are collapsed together. While this modification was necessary to improve the factorial validity of the M-KEDS, it may also impact how this instrument assesses the nuances of extreme weight control practices. An additional modification was to score body dissatisfaction as any discrepancy between ideal and current body silhouette figures. Finally, the M-KEDS does not capture binge eating. Thus, including an additional assessment of binge eating may be necessary for studies of disordered eating behaviors in this population.

Conclusions

The present study aimed to establish factorial validity of the psychometric properties of the KEDS in Hispanic-American adolescents to address the lack of psychometrically sound screening tools for body dissatisfaction and disordered eating behaviors in Hispanic adolescents. The KEDS is recommended by the American Academy of Child and Adolescent Psychiatry [22] and is widely being used in community and clinical populations to screen youth for eating disorders [23–33]. However, it has yet to be validated among Hispanic adolescents, an ethnic group with one of the fastest-growing populations in the US, among whom disordered eating behaviors are prevalent. This study has several potential implications, including cultural relevance of screening tools, improved screening, and potential for prevention and intervention. The study highlights the need for culturally validated tools when assessing disordered eating behaviors among different ethnic groups. The original KEDS was not a valid tool for the Hispanic adolescents in our sample. The M-KEDS, developed and validated in this study, provides a more accurate assessment for Hispanic adolescents by focusing on Negative Weight Attitudes and Extreme Weight Control Behaviors. By providing a validated screening tool, the study provides opportunities for early detection, prevention, and intervention in disordered eating behaviors among Hispanic adolescents. This tool can be particularly valuable in schools and clinical settings where early intervention can lead to better health outcomes. However, previous research shows that individuals from diverse racial and ethnic backgrounds are less likely to be screened for and receive treatment for disordered eating due to stereotypes about who is at risk for disordered eating that exclude individuals from diverse cultural groups. Further, previous literature examining the effectiveness of disordered eating treatment tends to lack consideration of cultural context, particularly for Hispanic adolescents, despite the high prevalence of disordered eating concerns among this group. While the M-KEDS can help identify disordered eating behaviors more effectively in Hispanic adolescents, potentially preventing misclassification, further work is needed inform and promote culturally appropriate screening, as well as train clinicians on who is at risk for disordered eating, and to tailor and improve accessibility of culturally appropriate treatment options.

Abbreviations

KEDS	Kids Eating Disorder Survey
M-KEDS	Modified Kids Eating Disorder Survey
CFA	Confirmatory Factor Analysis
KR-20	Kuder-Richardson Formula

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Authors' contributions

All authors substantially contributed to the work; Conceptualization, T.D.L., M.W., C.A.J., K.H., and T.A.L; methodology, T.D.L., M.W., C.A.J., K.H., and T.A.L; software, T.D.L., M.W., and T.A.L; validation, T.D.L., M.W., C.A.J., K.H., and T.A.L.; formal analysis, T.D.L., M.W., and T.A.L; investigation, T.D.L., M.W., C.A.J., K.H., and T.A.L resources, T.D.L., A.B.C., L.P.G., K.R.A., M.W., C.A.J., K.H., and T.A.L; data curation, T.D.L., A.B.C., L.P.G., K.R.A., M.W., C.A.J., K.H., and T.A.L; writing—original draft preparation, T.D.L., M.W., C.A.J., K.H., and T.A.L; writing—review and editing, T.D.L., A.B.C., L.P.G., K.R.A., M.W., C.A.J., K.H., and T.A.L; supervision, M.W., C.A.J., K.H., and T.A.L; project administration, T.D.L., A.B.C., L.P.G., K.R.A., M.W., C.A.J., K.H., and T.A.L; All authors have read and agreed to the published version of the manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request. with an approved data use agreement.

Declarations

Ethics approval and consent to participate

The study reported in this manuscript was approved by all appropriate Institutional Review Boards, and all parents provided written consent, and adolescents provided written assent prior to enrollment into the study.

Consent for publication

All authors consent to publication.

Competing interests

The authors declare no competing interests.

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