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Loss of Control Over Eating Scale (LOCES): Validation in undergraduate men and women with and without eating disorder symptoms

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ABSTRACT

The present study aimed to further validate the Loss of Control Over Eating Scale (LOCES) for use with undergraduate men and women with and without eating disorder (ED) symptoms. A total of 261 participants completed the LOCES and the Eating Disorder Examination – Questionnaire (EDE-Q) and were identified as non-clinical or having probable ED symptomatology based on previously used EDE-Q cutoff scores. Results indicated that the LOCES and its subscales were significantly associated with and a significant predictor of global ED pathology and binge episode frequency. The LOCES behavioral subscale appeared to be a stronger predictor of episode frequency compared to other subscales. The ED pathology groups reported significantly higher LOCES scores compared to the non-ED pathology groups. Binary logistic regression analyses revealed that the LOCES was able to accurately distinguish between those with ED pathology and those without ED pathology in the majority of cases. Findings from the present study suggest that the LOCES is highly predictive of ED pathology, strongly associated with ED cognitions and behaviors, and an accurate index for global eating disorder pathology. Future directions for research are discussed.

1. Introduction

Loss-of-control eating (LOC-eating) is characterized as a subjective perception of being compelled to eat or unable to resist or stop eating. It is common in the general population (Eisenberg, Nicklett, Roeder, & Kirz, 2011; Mitchison, Hay, Slewa-Younan, & Mond, 2014; Mond, Hay, Rodgers, & Owen, 2006) and has been found to be a better predictor of eating disturbances, comorbid psychopathology, psychological distress, and quality of life impairment than the amount of food consumed in a binge episode in both clinical and non-clinical populations (Brownstone et al., 2013; Latner & Clyne, 2008; Mond, Latner, Hay, Owen, & Rodgers, 2010; Vanucci et al., 2013; Wolfe, Baker, Smith, & Kelly-Weeder, 2009).

LOC-eating occurs in both "objective binge episodes," in which a large amount of food is consumed, and "subjective binge episodes," in which a normal or small amount of food is consumed (APA, 2013). Although "binge eating" entails both consumption of a large amount of food and a sense of loss of control over eating in current classification schemes, removal of the "large amount of food" component of this operational definition has been proposed for future revisions of both the DSM and ICD (Al-Adawi et al., 2013; Mond, 2013). This change would make the loss of control over eating the defining feature of a binge-eating episode.

The Loss of Control Over Eating Scale (LOCES; Latner, Mond, Kelly, Haynes, & Hay, 2014) is a self-report measure intended to assess multiple aspects of LOC-eating in both clinical and non-clinical populations. The LOCES items were developed based on qualitative literature, clinical descriptions, and eating disorder experts and patients. Within the original validation sample, LOCES scores were significantly associated with eating disturbances, general distress, functional impairment, and overall self-control (Latner et al., 2014). Given the prevalence and clinical significance of LOC-eating, further validation of this measure is needed, along with research to explore its use as a potential index for eating disturbances. Elucidation of the association between LOC-eating and the occurrence of objective and subjective binge eating episodes, as these constructs are traditionally assessed, would also be welcome.

The present study aimed to further validate the LOCES and examine its potential as an index of global eating disturbances in a non-clinical sample of undergraduate men and women. More specifically, this study examined the relationships between LOCES total and subscale scores, eating disorder (ED) pathology, and binge episode frequency. This study also investigated the LOCES's ability to accurately group participants into probable ED pathology and non-ED pathology groups and

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into groups of participants with or without regular episodes of objective or subjective binge eating.

2. Method

2.1. Participants and procedures

Undergraduate students were recruited from psychology courses at University of Hawaii and were offered course credit for participating in the study. Data collection occurred during Spring 2014. Participants ($n = 261$) were 75.9% ($n = 198$) female and 24.1% ($n = 63$) male, with a mean age of 21.14 years ($SD = 3.79$ years). Participant's mean body mass index (BMI) was 23.65 kg/m^2 ($SD = 5.06$). Of the participants, 42.5% identified themselves as primarily Asian, 21.1% as Caucasian, 10.7% as Pacific Islander/Hawaiian, 5.7% as Hispanic, 1.1% as African American, and 17.2% as mixed ethnicity. Participants completed questionnaires online via an Internet survey website.

2.2. Measures

2.2.1. Demographic questionnaire

The demographic questionnaire assessed self-reported age, year in school, ethnicity, height, and weight.

2.2.2. Loss of control over eating

The Loss of Control Over Eating Scale (LOCES; Latner et al., 2014) is a 24-item self-report measure intended to measure a global sense of loss of control over eating. The scale development study revealed three subscales: behavioral (7 items), cognitive/dissociative (4 items), and positive/euphoric aspects of LOC-eating (2 items). The behavioral subscale assesses physical behaviors associated with LOC-eating (e.g., eating past fullness, eating while feeling out of control). The cognitive/dissociative subscale intends to measure experiences of dissociation and cognitive aspects of the eating episode (e.g., feeling as though one is outside oneself, experiences feel unreal, unable to concentrate on anything besides eating). The positive/euphoric subscale assesses subjective positive experiences during the eating episode (e.g., feeling a sense of relief or a physical rush of euphoria). Participants self-report the frequency of disturbance within the last 28 days on a 5-point Likert scale ranging from *never* to *always*. Higher scores on the LOCES indicate a greater level of LOC-eating. The LOCES has shown good concurrent validity, internal consistency, and test-retest reliability in a different sample from the same university population (Latner et al., 2014). Within the current sample, the internal consistency of the LOCES was excellent ($\alpha = 0.95$).

2.2.3. Eating disturbances

The Eating Disorders Examination-Questionnaire (EDE-Q; Fairburn & Beglin, 1994) is a 28-item self-report version of the Eating Disorder Examination interview. The EDE-Q measures core attitudinal eating-related psychopathology focusing on the past 28 days and consists of four subscales: restraint, eating concern, shape concern, and weight concern, and a global score. Ratings are made on a seven-point Likert scale, with higher scores indicating a greater level of eating disturbance. Norms for the EDE-Q have been established within non-clinical populations of adult men and women (Lavender, De Yong, & Anderson, 2010; Mond et al., 2006). In the current sample, the EDE-Q subscales showed acceptable to good internal consistency ($\alpha = 0.80$, $\alpha = 0.76$, $\alpha = 0.90$, $\alpha = 0.84$, and $\alpha = 0.90$ for the restraint, eating concern, shape concern, weight concern, and global subscales respectively).

2.3. Statistical analyses

Due to the number of analyses and comparisons conducted within this study, a significance level of $\alpha = 0.01$ was used for all analyses. Bivariate correlation analyses and linear regressions were conducted to examine the relationships between LOCES scores, global eating pathology, and OBE and SBE frequencies. With the intent to examine the concurrent and discriminant validity of the LOCES subscales, Meng's z-test (Meng, Rosenthal, & Rubin, 1992) was used to compare the strength of correlation coefficients between LOCES subscale scores and binge episode frequency. Additionally, linear regressions were conducted using LOCES total score and its subscales as predictors for OBE and SBE frequency.

2.3.1. Probable and non-clinical eating disorder groups

A dichotomous variable was created to indicate the probable presence or absence of ED cognitions and behaviors, as done in previous studies (Latner, Mond, Vallance, Gleaves, & Buckett, 2013; Mond, Hay, Rodgers, & Owen, 2011). The variable was created using EDE-Q cut off points for clinically significant symptom levels (Hay, Marley, & Lemar, 1998; Mond et al., 2006). In order to be labeled as having probable ED pathology, participants must have scored 5 or higher on both items assessing overevaluation of weight and shape on the EDE-Q and must have met at least one of the following criteria: at least weekly objective binge episodes (OBEs), subjective binge episodes, (SBEs), self-induced vomiting, or laxative use, or at least 5 times weekly excessive exercise, during the past 28 days. The prevalence of each eating disorder feature is shown in Table 1.

2.3.2. Regular and infrequent binge eating groups

In order to further examine the relationship between binge eating and LOC-eating, two dichotomous variables were created to indicate the presence of regularly occurring objective and subjective binge eating episodes. In order to be labeled as having regular OBEs, participants must have reported at least one OBE per week for the last four weeks, consistent with the frequency criteria for bulimia nervosa and binge eating disorder in the DSM-5 (APA, 2013). Similarly, participants must have reported at least one SBE per week for the last four weeks to be labeled as having regular SBEs.

2.3.3. Analyses of ED pathology groups

Independent t-tests were performed to determine if the dichotomous ED pathology groups scored differently on the LOCES. Binary logistic regression analyses were conducted to investigate the LOCES' level of accuracy in categorizing participants into ED pathology and non-ED pathology groups, regular and infrequent OBE groups, and regular and infrequent SBE groups.

Table 1
Prevalence of ED features in the ED pathology group (n = 35), Non-ED pathology group (n = 226), and total sample (n = 261).

ED features	ED pathology frequency[a]	Non-ED pathology frequency	Total sample frequency
Shape/weight concern	100.00%	3.00%	11.90%
Eating concern[b]	4.20%	0.40%	0.80%
Restraint[b]	29.20%	2.10%	5.00%
Vomiting	4.20%	0.00%	0.40%
Laxative misuse	8.30%	0.00%	0.80%
Extreme dietary restriction[c]	33.3%	2.10%	4.60%
Excessive exercise	25.00%	5.90%	7.70%
OBEs	50.00%	16.00%	14.20%
SBEs	58.30%	12.20%	16.50%

[a] ED Pathology case status was determined by EDE-Q cut-off scores.
[b] Eating concern and Restraint were considered significant if participant scored 5 or greater on the corresponding EDE-Q subscale.
[c] Extreme dietary restriction was indicated if participants scored a 5 or greater on the EDE-Q item "*Have you ever gone for long periods of time (8 waking hours or more) without eating anything at all in order to influence your weight and shape?*").

3. Results

Consistent with the original validation study (Latner et al., 2014), the LOCES total and subscale scores were strongly associated with ED pathology within the total sample. Overall, higher LOC-eating was associated with greater levels of other ED pathology. The relationships between nearly all of the variables indicated medium to large effect sizes (mean $r = 0.46$, range = 0.15–0.66). A linear regression revealed that, while controlling for sex and BMI, total LOCES scores significantly predicted global ED pathology, $\beta = 0.60$, $t(236) = 12.02$, $p < 0.001$, and explained a significant proportion of variance in ED pathology scores, $R^2 = 0.47$, $F(1, 233) = 144.57$, $p < 0.001$.

LOCES total and subscale scores were also significantly associated with higher OBE and SBE frequency. See Table 2 for correlational data of the variables of interest. To investigate the concurrent and discriminate validity of the LOCES total and subscale scores, correlation coefficients between the LOCES scores and binge episode frequency were compared using Meng's z-test for comparing correlated coefficients (Meng et al., 1992). Analyses revealed the LOCES behavioral subscale had a significantly stronger association with OBE frequency than the cognitive/dissonance, $z = 3.00$, $p = 0.001$, and positive/euphoric subscales, $z = 2.25$, $p = 0.01$. The behavioral subscale had a significantly stronger association with SBE frequency than the positive/euphoric subscale, $z = 2.25$, $p = 0.01$, but not the cognitive/dissociative subscale, $z = 1.44$, $p = 0.08$.

Additionally, linear regression analyses were conducted to investigate the predictive strength of LOCES and its subscales for OBE and SBE frequency. Because the OBE and SBE frequency data were non-normally distributed (i.e., zero-inflated), two alternative approaches to the analyses were conducted. Specifically, Poisson regression and linear regression using square-root-transformed outcome variables were performed. Findings from these alternative approaches were unchanged from the original linear regression analyses. Therefore, only results involving the initial linear regression analyses are reported. While controlling for sex and BMI, higher total LOCES scores significantly predicted higher OBE and SBE frequency. Linear regression analyses also revealed that all LOCES subscales significantly predicted OBE frequency. See Table 3 for complete regression results. Consistent with findings from Meng's z-test analyses, the LOCES behavioral subscale yielded a larger effect size and explained greater amount of variance. Furthermore, both the behavioral and cognitive/dissociative subscales were significant predictors of SBE frequency; however, the positive/euphoric subscale was a nonsignificant predictor.

3.1. Analyses of ED pathology groups

The use of the EDE-Q cut off scores yielded a probable "ED pathology group" and a "non-ED pathology group." Additionally, the frequency cut off scores for the binge eating groups yielded regular and infrequent OBE groups and regular and infrequent SBE groups. See Table 4 for descriptive data for each group. On the EDE-Q global scale, the ED pathology group's mean score was similar to the scores of clinically diagnosed eating disorder populations (Aardoom, Dingemans, Op't Landt, & Van Furth, 2012; Mond, Hay, Rodgers, Owen, & Beumont, 2004; Mond, Owen, Hay, Rodgers, & Beaumont, 2005). There were no significant differences in BMI or age between the ED pathology and non-ED pathology groups, the regular OBE and infrequent OBE groups, and the regular SBE and infrequent SBE groups.

An independent-samples t-test revealed that the ED pathology group reported significantly higher LOCES scores than the non-ED pathology group, $t(259) = 6.49$, $p < 0.001$. A binary logistic regression analysis was performed to determine if the LOCES was accurate in categorizing participants into the ED pathology and non-ED pathology groups. The logistic regression model was statistically significant $X^2(1) = 26.60$, $p < 0.001$. The model explained 25.20% (Nagelkerke R^2) of the variance in the ED groups and correctly classified 90.40% of probable cases.

For the regular and infrequent OBE groups, results indicated that the regular OBE group reported significantly higher LOCES scores compared to the infrequent OBE group, $t(259) = 7.13$, $p < 0.001$. A second binary logistic regression analysis was conducted and the model was significant, $X^2(1) = 34.11$, $p < 0.001$, indicating that the LOCES accurately predicted whether participants would be categorized as regular or infrequent OBE. The model explained 23% (Nagelkerke R^2) of the variance in the OBE groups and correctly classified 80.10% of cases.

The regular SBE group ($M = 2.50$; $SD = 0.63$) reported significantly higher LOCES scores compared to the infrequent SBE group, $t(259) = 8.22$, $p < 0.001$. A final binary logistic regression analysis was conducted to examine the LOCES's accuracy in categorizing participants into regular or infrequent SBE groups; the model was significant $X^2(1) = 39.34$, $p < 0.001$. The model explained 30% (Nagelkerke R^2) of the variance in the SBE groups and correctly classified 85.10% of cases.

Table 2
Pearson product-moment correlations between LOCES total and subscale scores, Global ED pathology, and frequencies of objective and subjective binge episodes.

	EDE-Q global	OBE frequency	SBE frequency
LOCES total	0.65*	0.44*	0.44*
LOCES behavioral	0.59*	0.40*	0.40*
LOCES cognitive/dissociative	0.50*	0.27*	0.32*
LOCES positive/euphoric	0.29*	.0.26*	0.12

* $p < .001$.

Table 3
Regressions results for LOCES scores as predictors of OBE and SBE frequencies.

Outcome variable	Predictor variable	*b*	*SE*	β	R^2	pr^2	*P*
OBE frequency	LOCES total	2.40	0.38	0.41	0.17	0.16	>0.001
	Behavioral	1.99	0.31	0.42	0.18	0.16	>0.001
	Cognitive/dissociative	1.79	0.54	0.22	0.07	0.05	0.001
	Positive/euphoric	1.02	0.31	0.22	0.05	0.05	0.001
SBE frequency	LOCES total	2.95	0.44	0.43	0.19	0.17	>0.001
	Behavioral	2.14	0.36	0.29	0.15	0.14	>0.001
	Cognitive/dissociative	2.98	0.60	0.32	0.13	0.10	>0.001
	Positive/euphoric	0.73	0.36	0.13	0.03	0.02	0.05

Table 4
Descriptive data for probable ED group (n = 24) and non-clinical group (n = 237); regular OBE group (n = 50) and infrequent OBE group (n = 211); and regular SBE group (n = 43) and infrequent SBE group (n = 218).

	Probable ED group	Non-clinical group
Male *N*(%)	3 (12.50%)	60 (25.32%)
Female *N*(%)	21 (87.50%)	177 (74.68%)
Age *M*(*SD*)	20.43 (1.75)	21.21 (3.93)
BMI *M*(*SD*)	25.09 (6.54)	23.50 (4.88)
EDE-Q Global Score *M*(*SD*)	3.93 (0.76)	1.47 (1.14)
LOCES Score *M*(SD)	2.60 (0.61)	1.73 (0.63)
	Regular OBE group	Infrequent OBE group
Male *N*(%)	12 (24.00%)	51 (24.17%)
Female *N*(%)	38 (76.00%)	160 (75.83%)
Age *M*(*SD*)	21.28 (3.04)	21.10 (3.95)
BMI *M*(*SD*)	25.00 (5.91)	23.36 (4.83)
EDE-Q Global Score *M*(*SD*)	3.53 (1.17)	2.52 (1.27)
LOCES Score *M*(SD)	2.37 (0.61)	1.68 (0.62)
	Regular SBE group	Infrequent SBE group
Male *N*(%)	6 (13.95%)	57 (26.15%)
Female *N*(%)	37 (86.05%)	161 (73.85%)
Age *M*(*SD*)	20.45 (2.12)	21.27 (4.02)
BMI *M*(*SD*)	25.49 (7.32)	23.32 (4.48)
EDE-Q Global Score *M*(*SD*)	4.23 (0.98)	2.41 (1.15)
LOCES Score *M*(SD)	2.50 (0.63)	1.67 (0.60)

4. Discussion

Findings from the present study provided new insights into the relationship between the LOCES and ED pathology. The LOCES was strongly associated with global ED pathology as well as the frequency in which objective and subjective binge eating episodes occur. Examination of the LOCES subscale scores revealed that the behavioral subscale was more strongly associated with and a stronger predictor of both OBE and SBE frequency compared to the cognitive/dissociative and positive/euphoric subscales. Findings from both the regression analyses and Meng's z-tests suggested the behavioral aspects of LOC-eating may be more strongly associated with binge eating frequency than the subjective and cognitive aspects of LOC-eating. The behavioral subscale consists of items related to an individual's objective eating behaviors (e.g., "*I ate until I was uncomfortably full*" and "*I finished eating only to discover I had eaten more than I thought*"). These behavioral experiences may be easier to observe and identify or may occur more frequently during binge eating episodes compared to the subjective and internal cognitive aspects LOC-eating.

The ED pathology and non-ED pathology groups, as well as the regular and infrequent OBE and SBE groups, scored differently on the LOCES, suggesting that individuals with elevated levels of ED pathology report higher levels of LOC-eating than individuals with non-clinical levels of ED pathology. Additionally, the results of the logistic regression analyses indicated that the LOCES has the ability to accurately distinguish between individuals with high levels of ED pathology and those without ED pathology in the large majority of cases. These findings suggest that the LOCES has demonstrated high criterion validity and it may be prudent to include a measure of LOC-eating in both assessment and prevention efforts, although further research is needed.

4.1. Limitations and future directions

While the findings from this study further substantiate the LOCES as a valid measure and provide initial evidence for its use as an index of ED pathology, the research is not without limitations. Importantly, there is limited generalizability when using a non-clinical college sample. Although the high prevalence of eating pathology among undergraduate students makes this an important population for such research, further examination of the LOCES using clinical samples and samples from other age groups is needed. Further, the current sample was recruited from the same university as the original LOCES validation study. While participants in both studies did not overlap, the LOCES should be examined in other communities and populations. The current sample was also more ethnically diverse than typical college-age samples used in eating-related studies. Although, this sample's performance on the EDE-Q was consistent with scores found in other college-age populations (Mond et al., 2006; Mond et al., 2011), future research should examine the LOCES within the context of race and ethnicity.

Although well-established norms and cut-off scores of the EDE-Q were used to create the ED pathology and non-ED pathology groups (Hay et al., 1998; Latner et al., 2013; Mond et al., 2004; Mond et al., 2005; Mond et al., 2011), the use of a self-report assessment of ED symptomatology was a limitation of this study. For example, it is unknown how accurate participants were in assessing the amount of food consumed when reporting OBE and SBE frequency. Providing examples of "an unusually large amount of food" in future research of this kind would likely be helpful in improving the accuracy of self-report assessment of these behaviors (Goldfein, Devlin, & Kamenetz, 2005). The use of alternative measures of ED pathology, i.e., other than the EDE-Q, would also be of interest in future research.

Finally, other potentially important constructs related to LOC-eating, such as quality of life and general psychopathology, were not included in this study and the relatively small number of male participants precluded meaningful analysis of sex differences in the associations of interest. The inclusion of these additional measures and of subgroup sample sizes permitting analysis of sex differences should also be considered in future research addressing the utility of the LOCES.

4.2. Conclusions

The findings from the present study suggest that the LOCES and its subscales are strongly associated with and predictive of global ED pathology and binge episode frequency. Additionally, the LOCES was indicated as moderately accurate in detecting likely cases of individuals with high levels of ED pathology. The LOCES' ability to accurately categorize most individuals into groups with and without ED pathology suggests its utility as a potential screening tool for eating disorders, though further research is needed. Future studies examining the psychometric properties of the LOCES should be conducted in both clinical and non-clinical samples and should include a broader range of outcome measures and subgroup sample sizes permitting analysis of sex differences in associations of interest.

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