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Assessment of Loss-of-Control Eating in Healthy Youth by Interview and Questionnaire

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Abstract

Objective: To evaluate two questionnaires, an updated youth version of the Questionnaire on Eating and Weight Patterns (QEWP-C-5) and the Loss-of-Control (LOC) Eating Disorder Questionnaire (LOC-ED-Q), against the Eating Disorder Examination (EDE) interview to assess the presence of LOC-eating among youth.

Method: Two-hundred-eighteen youths (12.8±2.7 years) completed the QEWP-C-5, LOC-ED-Q, and EDE, depressive and anxiety questionnaires, and adiposity assessment. Sensitivity, specificity,

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Data Availability: The data that support the findings of this study are available from the corresponding author upon request.

Trial Registration: ClinicalTrials.gov ID#s: NCT00263536 and NCT02390765

positive predictive value, negative-predictive-value, and diagnostic accuracy were calculated; Cochran's *Q*, and McNemar's tests were used to compare measures. Receiver Operating Characteristic area under the curve (AUC) analyses were performed. Mood and adiposity based on LOC-eating presence and absence based on each measure were examined.

Results: The QEWP-C-5 and LOC-ED-Q demonstrated poor sensitivity (33%; 30%) and high specificity (95%; 96%) compared to the EDE. The AUCs suggested neither the QEWP-C-5 (0.64) nor the LOC-ED-Q (0.62) demonstrated acceptable diagnostic accuracy. Comparing distributions of LOC-eating presence between assessments, the QEWP-C-5 and EDE did not differ significantly (p=.10), while the LOC-ED-Q and EDE had significantly different distributions (p= .03). LOC-eating presence was associated with higher depressive and anxiety symptoms across all measures (ps < .02). Greater adiposity (ps < .02) was associated with LOC-eating presence on the EDE and LOC-ED-Q, and higher BMI*z* (p = .02) on the LOC-ED-Q.

Discussion: Neither the QEWP-C-5 nor the LOC-ED-Q were sensitive for identifying LOC-eating presence as determined by the EDE, although both were associated with greater mood symptoms. Research is needed to improve self-report questionnaires to better screen for LOC-eating presence among pediatric populations.

Keywords

assessment; loss-of-control eating; children; adolescents; adiposity

Introduction

Binge-eating disorder (BED) appears prevalent among adults, with lifetime estimates up to 3.5% (Hudson, Hiripi, Pope, & Kessler, 2007); however, few children appear to meet criteria for full-syndrome BED (Tanofsky-Kraff, Marcus, Yanovski, & Yanovski, 2008). The variance in prevalence estimates may be at least partly due to assessment challenges specific to children, particularly regarding their eating behaviors, which make BED difficult to diagnose among this age group. For example, it can be difficult to assess what constitutes an "unambiguously large" amount of food during development, given both the wide range of children's energy needs (Shomaker et al., 2010) and a tendency for youth to misreport intake (Ventura, Loken, Mitchell, Smiciklas-Wright, & Birch, 2006; Wolkoff et al., 2011). Moreover, associated emotions and behaviors related to disordered-eating may be challenging for young children to recognize or describe. However, youth, particularly those with higher weight, frequently report a sense of loss-of-control (LOC) while eating, a hallmark feature of BED (Morgan et al., 2002; Tanofsky-Kraff et al., 2004). Indeed, to identify youth at risk for obesity and psychopathology, the subjective feeling of LOC appears to be an even more salient feature than the amount of food reportedly consumed (e.g., Shomaker et al., 2010). The overall prevalence of recent LOC-eating among children with high weight is ~31.2%, with a higher prevalence among treatment-seeking youth (He, Cai, & Fan, 2017). Prospectively, youth who report LOC-eating have been found to be at higher risk for excess weight gain (Field et al., 2003; Sonneville et al., 2013; Tanofsky-Kraff et al., 2009), fat gain (Tanofsky-Kraff et al., 2006), and worsening metabolic health (Tanofsky-Kraff et al., 2012). Youth who report even low-frequency LOC-eating are also more likely to develop partial or full-syndrome BED and exacerbated mood symptoms, with

youth who have reported at least one LOC episode being distinguishable from those who reported none (Hilbert, Hartmann, Czaja, & Schoebi, 2013; Tanofsky-Kraff, Faden, Yanovski, Wilfley, & Yanovski, 2005; Tanofsky-Kraff et al., 2011).

Although data highlight the clinical utility of the LOC construct, evaluating LOC-eating can be challenging given the subjectivity of the definition. Interview methods that are able to clarify difficult concepts are often considered a more rigorous approach in the assessment of eating disorders, particularly those that encourage respondents at the outset to fill out corresponding calendars in order to minimize memory recall bias and distortion, as has been found in adults (Loftus & Marburger, 1983). However, interviews are time-consuming, require extensive training, and can introduce interviewer bias as well as participant self-consciousness (Schvey, Eddy, & Tanofsky-Kraff, 2016). Questionnaires have been developed to more easily assess LOC-eating within clinical or research settings, but these measures do not appear to assess LOC-eating adequately, and have generally been less-frequently examined in samples of youth without overweight. For example, the Questionnaire on Eating and Weight Patterns for Adolescents (QEWP-A; Johnson, Grieve, Adams, & Sandy, 1999) was designed to assess a clinical diagnosis of BED and bulimia nervosa, and has been used to assess LOC-eating among non-treatment-seeking youth (Morgan et al., 2002; Zocca et al., 2011). However, the QEWP-A demonstrated low sensitivity when compared to an interview (sensitivity ≤17%; Tanofsky-Kraff et al., 2003). In 2013, revised criteria for BED were published (American Psychiatric Association, 2013), which prompted development of an updated version of the adult QEWP (QEWP-5; Yanovski, Marcus, Wadden, & Walsh, 2015). An Italian version of the QEWP-5 showed moderate sensitivity for identifying the presence of BED (<50%) in treatment-seeking adults with obesity (Calugi et al., 2019). The QEWP-5 has been modified for children and adolescents (QEWP-C-5), but has yet to be examined against an interview for assessing LOC-eating.

An alternative measure, the Loss-of-Control Eating Disorder Questionnaire (LOC-ED-Q), was developed to screen for LOC-eating presence, as well as Loss-of-Control Eating Disorder (LOC-ED), a provisional diagnostic category for youth presenting with binge-type eating(Tanofsky-Kraff et al., 2008). Constructs assessed by the LOC-ED-Q were based on a multi-site study that elucidated the behavioral, contextual and emotional correlates of LOC-eating (Tanofsky-Kraff et al., 2007) in order to improve upon prior inadequate measures of LOC-eating in youth. Two studies have used the LOC-ED-Q to assess the presence of LOC-eating (English et al., 2019; Mazzeo et al., 2016). English et al. (2019) found that youth with LOC-eating as identified by the LOC-ED-Q showed increased susceptibility to overeating in response to large portions, and using fMRI, found that such children showed greater cerebellar activation when responding to food cues compared to those who did not report LOC. Mazzeo et al. (2016) evaluated two interventions to target disordered-eating behaviors, and found both reduced LOC-eating based on the LOC-ED-Q. Despite these data, the validity of the measure has not been compared with a well-validated interview method.

We therefore investigated the performance of the self-report QEWP-C-5 and LOC-ED-Q measures against a clinical interview for assessing for the presence of LOC-eating. Given that the both the QEWP-C-5 and LOC-ED-Q were developed based upon updated

recommendations (American Psychiatric Association, 2013) and empirical data (Tanofsky-Kraff et al., 2007), we explored the performance of the self-report QEWP-C-5 and LOC-ED-Q measures against a clinical interview for assessing for the presence of LOC-eating. We tested the sensitivity and specificity for LOC-eating when compared to the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993), the most frequently used interview in the field, to examine if similar distribution of LOC-eating presence (high marginal homogeneity) between responses on the EDE, QEWP-C-5, and LOC-ED-Q would be observed. Additionally, as the presence of recent LOC-eating by interview has been consistently associated with higher mood and anxiety symptoms and BMIz, we investigated the concurrent validity of the three measures by examining if LOC-eating presence on each measure was also associated with higher adiposity, and more reported symptoms of anxiety and depression.

Materials & Methods

Participants & Procedure

Participants were a convenience sample of healthy boys and girls (8–17 years old) who enrolled in an ongoing longitudinal non-intervention study (Children's Growth and Behavior Study; Clinical Trials Identifier: NCT02390765) examining how psychological, genetic and environmental factors influence eating behavior and health over time. The protocol was approved by the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Institutional Review Board. Participants were recruited via flyers and mailings to families throughout the Washington, DC metropolitan area. All participants were studied at the National Institutes of Health Hatfield Clinical Research Center. Exclusion criteria were assessed during physical examination that involved a parent-reported family healthy history, and using administered tests. Youth were excluded due to a: 1) major medical illness or obesity-related medical complication; 2) use of medication known to impact weight or eating behaviors; 3) presence of a full-syndrome psychiatric disorder (other than BED) as assessed by the Schedule for Affective Disorders and Schizophrenia for School-Age Children (Kaufman et al., 1997); 4) a recent weight loss exceeding 5% of their total body weight; 5) a body mass index (BMI, kg/m^2) lower than the 5^{th} percentile adjusted for age and sex, as measured during screening; 6) regular and current use of illicit substances; and 7) a Full Scale Intelligence Quotient <70 by the Wechsler Intelligence Scale for Children (Wechsler, 2011).

Parents and children provided written consent and assent, respectively. Per protocol, both questionnaires were administered prior to the interview. Participants completed questionnaires on their own. Difficult words were defined, as needed. However, additional clarification from the research team was limited and concepts were not elaborated upon.

Measures

Physical Measurements—Height was measured in triplicate to the nearest millimeter on a calibrated stadiometer. Weight, obtained after participants observed an overnight fast, was measured to the nearest 0.1 kg on a calibrated digital scale. Both were used to calculate BMI*z*, standardized for age and sex according to the U.S. Centers for Disease Control and

Prevention growth standards (Kuczmarski et al., 2002). Body fat was measured using dual-energy X-ray absorptiometry (Hologic QDR-4500 or GE Lunar iDXA, GE Healthcare, Madison WI; software GE encore 15).

Interview—The EDE (EDE; Fairburn & Cooper, 1993) or the adapted version for children (Bryant-Waugh, Cooper, Taylor, & Lask, 1996) were administered by a trained research team member as previously described (Tanofsky-Kraff et al., 2004). The child version was, per protocol, administered for youth under 13, and for older participants in need of additional clarification. Participants were coded as having LOC-presence if they endorsed at least one LOC-eating episode within the past three months. The EDE and child version have been effectively combined and have shown excellent inter-rater reliability for the presence of LOC-eating (Glasofer et al., 2007; Tanofsky-Kraff et al., 2007; Tanofsky-Kraff et al., 2004).

Questionnaires—The QEWP-C-5, adapted from the QEWP-5 (Supplement 1; Yanovski et al., 2015), is a 32-item self-report measure designed to assess the criteria used to make a diagnosis of BED, as well as the presence and frequency of LOC-eating in children and adolescents in the past three months. The questionnaire is an updated version of the QEWP-A (Johnson et al., 1999), which was developed from the original adult version (Spitzer et al., 1993). The QEWP-A has been used with children as young as five-years-old (Tanofsky-Kraff et al., 2003). and has demonstrated suitable concurrent validity (Johnson, Grieve, Adams, & Sandy, 1999) and test-retest reliability (Johnson, Kirk, & Reed, 2001), however the QEWP-C-5 has yet to be examined to determine its' utility for assessing LOC-eating in youth.

The LOC-ED-Q (Supplement 2) is a 19-item questionnaire developed by the authors (MTK, SZY, JAY) to assess presence and frequency of LOC-eating, as well as provide a provisional diagnosis of LOC-ED. The questionnaire's language was developed to be clear for young children.

The Children's Depression Inventory (CDI) is a 27-item questionnaire that measures depressive behaviors and symptoms in the past two weeks (Kovacs, 1992). The total score ranges from 0–54, with higher scores signifying greater depression. A total score of 19 is frequently used as the clinical cut-off for risk of depression (Kazdin & Petti, 1982). The CDI demonstrates good internal consistency and convergent and discriminant validity (Carey, Faulstich, Gresham, Ruggiero, & Enyart, 1987). In this sample, the CDI demonstrated good internal consistency (Cronbach's α = .86).

The State-Trait Anxiety Inventory for Children- Trait Subscale is a 20-item self-report measure that assesses anxiety-related symptoms (Spielberger & Edwards, 1973). Subscale scores range from 20–60 and a total score is calculated by summing each item rating Despite no clinical cutoff, higher scores indicate more anxiety. The measure is well-validated and demonstrates high internal consistency (Muris, 2002). In this sample, the questionnaire demonstrated good internal consistency, Trait Subscale Cronbach's α=.90.

Statistical Analysis—Analyses were performed with IBM SPSS 25.0 (IBM Corp, Armonk, NY). Data were screened for normality and extreme outliers, defined as more than

three SDs from the mean, and were recoded to three SDs from the mean (n = 14). Participants who had missing data from the LOC-eating measures (n = 17, 7.2%) were excluded from this analysis. Independent samples t-tests, Pearson's Chi-square tests, and Fisher's exact tests, as appropriate, were used to compare participant characteristics between youths included in this analysis and youths with missing data. Participant characteristics included age (y), sex (coded as female=0 or male=1), race (coded as 0=Non-Hispanic White or 1=other), BMIz, fat mass (%), depressive and anxiety symptoms.

To evaluate the accuracy of the QEWP-C-5 and LOC-ED-Q for detecting LOC-eating presence as compared to the EDE, sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and diagnostic accuracy were calculated for each measure (McNeil, Keller, & Adelstein, 1975). Test characteristics were also examined after combining the QEWP-C-5 and LOC-ED-Q, such that LOC-eating was deemed present if reported on at least one of the two measures. Given the broad age range of youth in the study, test characteristics were calculated separately within children (≤11 years) and adolescents (≥12 years). Sensitivity was calculated as the proportion identified as having LOC-eating on the questionnaire and EDE (true positives) out of those identified with LOC-eating on the EDE. Specificity was determined as the proportion of those who did not report LOC-eating as on the questionnaire or EDE (true negatives) out of those without LOC-eating on the EDE. The PPV was calculated as the proportion of true positives out of those who reported LOC-eating on the questionnaire. The NPV was calculated as the proportion of true negatives out of those who did not report LOC-eating on the questionnaire. Diagnostic accuracy (efficiency) was calculated as the proportion of true positives and true negatives out of all participants. Given missing data within each measure were minimal, two sensitivity analyses were conducted for all diagnostic characteristics to examine the impact of missing data on results (Jakobsen, Gluud, Wetterslev, & Winkel, 2017). The first analyses assumed all missing data were ideal (e.g., if a participant reported no LOC-eating on the EDE but was missing QEWP data, then we recoded the QEWP data as if there was no LOC-eating). The second analyses assumed all missing data were not ideal (e.g., if a participant reported no LOC-eating on the EDE but was missing QEWP data, then we recoded the QEWP data as if there was LOC-eating). Moreover, in order to examine whether characteristics might be improved when the two questionnaires were examined together (i.e., if participants endorsed LOC-eating on either measure, they were categorized as reporting LOC-eating), the measures were combined and tests were repeated.

Receiver operating characteristic (ROC) curves were computed to compare the frequency of reported LOC-eating episodes on the two questionnaires to LOC-eating presence on the EDE. The sensitivity and specificity were calculated for cut-off scores for each ROC curve and the area under the curve (AUC) was determined. Non-parametric tests examined whether AUCs were significantly different from an AUC = 0.50, which would indicate the questionnaire's discrimination ability was not better than chance. AUC calculations were repeated separately within children and adolescents.

The QEWP-C-5 queried participants regarding how many LOC episodes were experienced on average, per week, in the past three months, while the LOC-ED-Q asks about each month separately. On both questionnaires' answers are displayed as drop-down options of

increasing numeric ranges, the midpoint value for each range was used for analysis. Answers were coded to reflect the timeframe being assessed. Options included “less than 1 time a week” (coded as 2 episodes on the LOC-ED-Q or 6 episodes on the QEWP-C-5, “1 time a week” (coded as 4 or 12), “2 or 3 times a week” (coded as 10 or 30), “4–7 times a week” (coded as 22 or 66), “8–13 times a week” (coded as 42 or 126) and “14 or more times a week” (coded as 56 or 168). LOC-eating presence as reported on the EDE was used as the criterion variable (Swets, 1988).

Cochran’s Q test and post-hoc McNemar tests were performed to compare the distribution (the marginal homogeneity) of LOC-eating presence between measures. Lastly, independent samples t-tests, Pearson’s Chi-squared tests, and Fisher’s exact tests were also used to examine participant characteristics by LOC-eating status, as assessed by the three measures. Cohen’s d and the phi coefficient (φ) are reported as effect sizes for each analysis. Within the study sample, missing data were minimal (<5%) and were handled in each analysis by using listwise deletion. No statistical test assumptions were violated, all tests were two-tailed, and significance was considered when p-values were < .05.

Results

Two-hundred-eighteen participants (12.8±2.7 years; 56% female; 46% Non-Hispanic White) had valid measures of the EDE, QEWP-C-5, and LOC-ED-Q and were included in the final analyses. Participants whose data were excluded from analyses due to missing LOC-eating data (n=17) were younger [10.9±3.0 years; $t(16.82) = -2.5$, $p = .02$, $d = .20$] and less likely to be Non-Hispanic White [$\chi^2(1) = 4.7$, $p = .03$, $\varphi = -.14$] than those included. Neither BMIz [$t(230) = -1.8$, $p = .08$, $d = .49$] nor sex [$\chi^2(1) = 0.8$, $p = .36$, $\varphi = -.06$] were significantly different. Sensitivity analyses revealed that missing data would not have impacted our interpretation of diagnostic characteristics (Supplement 3).

According to the EDE, 30 (13.8%) youth reported LOC-eating, compared to 20 (9.2%) who reported on the QEWP-C-5 and 17 (7.8%) who reported on the LOC-ED-Q. Using the report of one or more LOC episode(s) as the criterion for LOC-eating presence, neither the QEWP-C-5 nor the LOC-ED-Q had acceptable diagnostic characteristics for identifying the presence of LOC-eating when compared to the EDE (Table 1). The QEWP-C-5 showed poor sensitivity (33.3%), high specificity (94.7%), poor PPV (50.0%), high NPV (89.9%), and moderate diagnostic accuracy (86.2%). Likewise, the LOC-ED-Q showed poor sensitivity (30.0%), high specificity (95.7%), poor PPV (52.9%), high NPV (89.6%), and moderate diagnostic accuracy (86.7%), when compared to the EDE. When the QEWP-C-5 and LOC-ED-Q were combined, sensitivity (40.0%) increased marginally, but diagnostic accuracy (85.8%) was not improved. The AUC analyses for both the QEWP-C-5 (AUC=0.64, 95% CI=[0.52, 0.76], p=.01) and LOC-ED-Q (AUC=0.62, 95% CI=[0.51, 0.74], p=.03) were significantly different from chance (AUC=0.50), but demonstrated poor diagnostic ability to detect LOC-eating presence on the EDE. The ROC curve analyses revealed that the best cut-off scores for LOC-eating frequency on each questionnaire had poor sensitivity and high specificity (QEWP-C-5: cut-off=6.0, sensitivity=44.4%, specificity=96.3%; LOC-ED-Q: cut-off=2.0, sensitivity=33.3%, specificity=97.1%).

Analyzing children and adolescents separately, test characteristics for the two questionnaires were not improved for either group (Table 1). With respect to AUC analyses, only adolescent responses on the QEWP-C-5 remained significantly different from chance (AUC=.67, 95% CI=[.52, .81], p=.01), while child responses on the QEWP-C-5 did not (AUC=.59, 95% CI=[.37, .81], p=.40). On the LOC-ED-Q, neither child (AUC=.64, 95% CI=[.42, .86], p=.19) nor adolescent (AUC=.63, 95% CI=[.48, .77], p=.06) subgroup's AUC were significantly different from chance. When examining differences in distribution of LOC-eating presence (marginal homogeneity) between measures, the EDE, QEWP-C-5, and LOC-ED-Q significantly differed [$Q(2) = 7.7$, $p = .02$]. Post-hoc analyses showed the QEWP-C-5 and EDE were not significantly different [$Q(1) = 2.6$, $p = .10$], while the LOC-ED-Q and EDE differed significantly [$Q(1) = 4.5$, $p = .03$]. When the QEWP-C-5 and LOC-ED-Q were compared to one another, the distribution of LOC-eating presence did not significantly differ [$Q(1) = 0.7$, $p = .41$].

Participant characteristics and test statistics by LOC-eating status as determined by each measure are shown in Table 2. Youth who endorsed LOC-eating on the EDE were significantly more likely to be female, had a higher fat mass percentage, and reported more depressive and anxiety symptoms than youth who did not endorse LOC-eating on the EDE (Table 2; ps ≤ .01). There were no significant differences in BMIz for those with- and without LOC-eating according to the EDE (p = .09). For the QEWP-C-5, youth who reported LOC-eating had more depressive and anxiety symptoms than youth who did not report LOC-eating on the QEWP-C-5 (ps ≤ .02). There were no significant differences in sex distribution, BMIz, or adiposity for those with- and without LOC-eating by QEWP-C-5 (ps > .05). For the LOC-ED-Q, youth who endorsed LOC-eating had a higher fat mass and BMIz and reported more depressive and anxiety symptoms than youth who did not endorse LOC-eating (ps ≤ .02). However, there were no significant differences in sex distribution for those with- and without LOC-eating by LOC-ED-Q (ps > .05). For all measures, youth without LOC-eating did not differ from those without LOC-eating with regard to age and race/ethnicity distribution (ps > .05).

Discussion

With a goal of identifying well-performing screening measures for children with LOC-eating, this study compared the utility of two self-report measures for assessing LOC-eating presence among a non-clinical sample of children and adolescents. Findings demonstrated that neither the QEWP-C-5 nor the LOC-ED-Q were sensitive for identifying the presence of LOC-eating when compared to the interview, although both were highly specific for detecting absence of the behavior. ROC curves indicated the AUC of both questionnaires, were significantly better than chance, but demonstrated unacceptable discrimination ability for LOC episode presence. Moreover, the confidence intervals overlapped substantially for both questionnaires such that neither assessment performed significantly better than the other. When comparing the distribution of LOC-eating presence across measures, the EDE and LOC-ED-Q showed significant disagreement, while the EDE and QEWP-C-5, as well as the LOC-ED-Q and QEWP-C-5, showed modest agreement. We also found mixed validity for reported LOC eating across the three measures. LOC-eating presence on the EDE and

LOC-ED-Q was associated with greater adiposity and LOC-eating presence across all three measures was associated with greater anxiety and depressive symptoms.

The LOC-ED-Q and QEWP-C-5 demonstrated only marginally better sensitivity than previous studies examining the QEWP-A (sensitivity ≤17%; Tanofsky-Kraff et al., 2003). Compared to each other, the LOC-ED-Q and QEWP-C-5 demonstrated similarly low sensitivity, high specificity, low PPV, high NPV, and moderately high diagnostic accuracy for the entire sample as well as when the younger and older children were examined separately. Sensitivity was minimally improved when results from the measures were combined and compared to the EDE, suggesting that future assessments would not be improved by combining questionnaires. Our findings are not altogether surprising. Literature examining self-report assessments of objective binge episodes, wherein an unobjectively large amount of food is consumed, for both adults (Birgegård, Norring, & Clinton, 2014) and children (Decaluwe & Braet, 2004; Tanofsky-Kraff et al., 2003) have also demonstrated poor concordance with interview assessments. Indeed, perception of a large amount of food and the experience of LOC-eating are both subjective concepts. Moreover, when comparing the distribution of LOC-eating presence between measures, the QEWP-C-5 was not significantly different from the EDE and LOC-ED-Q, while the LOC-ED-Q did not show agreement with the EDE. More data are needed to elucidate specific elements of the QEWP-C-5 and LOC-ED-Q that contributed to this difference, and whether the QEWP-C-5 adds any clinical benefit to determine youth who may need a more thorough diagnostic assessment. Overall, our findings suggest neither assessment is an adequate screener for LOC-eating in non-clinical populations, given ~70% of children who reported LOC-eating by EDE were not identified by the questionnaires.

At present, the EDE remains the preferred assessment for identifying youth with LOC-eating. The EDE allows the interviewer to assess participant comprehension and clarify difficult constructs, so it may be that youth who do not identify LOC-eating when presented with the wording in the questionnaire are only being identified when assessed face-to-face. Unlike self-report methods, the EDE involves developing a calendar, which grounds interviewees to events and activities which assist in recall. Without anchoring youth to prior events, self-report questionnaires may be inadequate for accurate recall of LOC-eating. In order to improve assessment, additional data are needed to elucidate differences between youth who report LOC-eating on questionnaires and those only identified by interview, as well as whether reporting on any specific measure is predictive of heightened risk for developing disordered-eating. Moving forward, researchers should consider adding procedures to improve memory recall about specific time frames. For example, calendar completion or use of probes to query about recent life events, as well as additional queries or clarifications of LOC-eating in order to better capture the construct. Given that there are few data on parent reports of children's LOC-eating, it is possible that the parent version of the QEWP-5 would have improved sensitivity to LOC-eating as reported on the EDE. Indeed, a comparison of the child EDE with the previous parent version of the QEWP demonstrated slightly higher sensitivity (50%) for the presence of child binge episodes (Tanofsky-Kraff, Yanovski, & Yanovski, 2005). Yet, a comparison of the previous versions of the child and parent QEWP showed that parent reports had low sensitivity for binge-eating behaviors (20%); however, only the parent report found binge-eating to be associated with adiposity

(20%; Steinberg et al., 2004). Further evaluation is needed to assess the utility of the updated parent QEWP-5 for assessing the presence of LOC-eating.

Reports of LOC-eating on the EDE and LOC-ED-Q, but not the QEWP-C-5, were significantly associated with greater adiposity. The LOC-ED-Q, but neither the EDE nor the QEWP-C-5, found that LOC-eating was significantly associated with BMI*z*. These results are partially consistent with a prior study examining the relationship between LOC-eating, as reported on the EDE, and adiposity (Matherne et al., 2015). By contrast, the link between LOC-eating and BMI*z* based on the EDE and QEWP-C-5 was not observed. This may be partly due to the limitations that result from use of community samples in that, as expected among unselected youths, only about 20% of participants in our sample had obesity, and an even smaller proportion reported LOC-eating on the EDE. Indeed, such differences might be more easily observed in sample enriched for youth with higher weight. Alternatively, inconsistencies may be the result of differences in questionnaire format. Future longitudinal designs should assess whether youth who report LOC-eating presence on the LOC-ED-Q are at heightened risk for weight gain or metabolic complications, compared to those who report LOC-eating on the QEWP-C-5, and to elucidate previously observed differences in outcomes based on LOC-eating presence as reported on the LOC-ED-Q (English et al., 2019; Mazzeo et al., 2016). Consistent with hypotheses, all three measures were associated with greater depressive and anxiety symptoms. Findings support data that youth with LOC-eating, whether identified by interview or self-report, appear to present with higher psychological symptoms than those without any LOC-eating, although it is possible that youth who report disordered-eating, regardless of the differences in assessment, may be more likely to also report greater negative mood symptoms (Goldschmidt, 2017). Nonetheless, these results support the compelling need for additional data to elucidate the mechanisms of LOC-eating, in order to explain these relationships and ultimately contribute to updated screening instruments.

Study strengths include the community-recruited sample of racially/ethnically diverse boys and girls, the use of a well-validated interview, and objective measures of height, weight and adiposity. Although measures assessing LOC-eating are typically examined within treatment-seeking or populations with overweight (Blomquist et al., 2014; Kass et al., 2017), our study sample looked at healthy participants - a valuable group for informing prevention efforts for youth vulnerable to developing obesity and disordered-eating. A limitation of our study is the use of a convenience sample willing to enroll in a longitudinal non-treatment clinical trial. Moreover, age and race characteristics differed between participants included and excluded from analyses, which could have introduced unknown selection bias. Although the protocol states the LOC-ED-Q and QEWP-C-5 are to be administered prior to interview measures, our data regarding the exact time for each interview was limited; therefore, we were not able to confirm whether this order of assessments was consistently implemented. However, if the EDE had been conducted before the questionnaires, it would be expected to have explicated the concept of LOC eating for children and, if there were any effect, might have resulted in greater concordance between interview and questionnaires and an artificially increased sensitivity.

Neither the QEWP-C-5 nor the LOC-ED-Q are comparable to the EDE in assessing LOC-presence in non-treatment-seeking youth. Further studies are warranted to investigate if either measure might be longitudinally associated with adverse outcomes. Evaluation of how self-report questionnaires might clarify the construct of LOC-eating are needed in order to improve the feasibility of assessing the behavior in clinical and research settings.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Diagnostic Characteristics of Measures to Identify LOC-eating

Measure	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value	Diagnostic Accuracy
QEWP-C-5	.33	.95	.50	.90	.86
<12 years	.22	.95	.40	.89	.86
≥12 years	.38	.94	.53	.90	.86
LOC-ED-Q	.30	.96	.53	.90	.87
<12 years	.33	.94	.43	.90	.86
≥12 years	.29	.97	.60	.89	.87
QEWP-C-5 or LOC-ED-Q	.40	.93	.48	.91	.86
<12 years	.60	.97	.71	.96	.94
≥12 years	.38	.94	.50	.90	.86

Note. QEWP-C-5 = Questionnaire on Eating and Weight Patterns-5 Children/Adolescent.

LOC-ED-Q = Loss of Control Eating Disorder Questionnaire. QEWP-C-5 or LOC-ED-Q was calculated if LOC-eating was reported on at least one questionnaire.

Table 2.

Participant Demographics by LOC Status as Determined by the EDE, QEWP-C-5, and LOC-ED-Q

	EDE			QEWP-C-5			LOC-ED-Q		
	LOC Presence (*n* = 30)	**LOC Absence (*n* = 188)**	**Test Statistics**	**LOC Presence (*n* = 20)**	**LOC Absence (*n* = 198)**	**Test Statistics**	**LOC Presence (*n* = 17)**	**LOC Absence (*n* = 201)**	**Test Statistics**
Age (years), *M* (*SD*)	13.2 (2.7)	12.8 (2.7)	$t(216) = -0.7$, $p = .46$, $d = .14$	13.5 (2.6)	12.8 (2.7)	$t(216) = -1.2$, $p = .24$, $d = .28$	13.0 (3.0)	12.8 (2.6)	$t(216) = -0.3$, $p = .79$, $d = .06$
Sex, *n* (%) female	23 (76.7)	98 (52.1)	$\chi^2(1) = 6.3$, $p = .01$, $\varphi = -.17$	13 (65.0)	108 (54.5)	$\chi^2(1) = 0.8$, $= .37$, $\varphi = -.06$	12 (70.6)	109 (54.2)	$\chi^2(1) = 1.7$, $p = .19$, $\varphi = -.09$
Race/Ethnicity, *n* (%)			$\chi^2(1) = 0.6$, $p = .44$, $\varphi = -05$			$\chi^2(1) = 0.4$, $p = .54$, $\varphi = .04$			$\chi^2(1) = 0.9$, $p = .33$, $\varphi = .07$
Non-Hispanic White	12 (40.0)	89 (47.3)		8 (40.0)	93 (47.0)		6 (35.3)	95 (47.3)	
Non-Hispanic Black	10 (33.3)	47 (25.0)		9 (45.0)	48 (24.2)		8 (47.1)	49 (24.4)	
Other/Unknown	4 (13.3)	41 (21.8)		2 (10.0)	43 (21.7)		0 (0.0)	45 (22.3)	
Hispanic/Latino	4 (13.3)	11 (5.9)		1 (5.0)	14 (7.1)		3 (17.6)	12 (6.0)	
BMI*z*, *M* (*SD*)	0.9 (0.9)	0.5 (1.0)	$t(215) = -1.7$, $p = .09$, $d = .35$	0.9 (1.0)	0.5 (1.0)	$t(215) = -1.5$, $p = .14$, $d = .35$	1.2 (1.0)	0.5 (1.0)	$t(18.92) = -2.5$, $p = .02$, $d = .62$
Fat Mass Percentage[†], *M* (*SD*)	32.4 (7.7)	27.4 (9.4)	$t(46.23) = -3.4$, $p = .001$, $d = .61$	30.1 (9.8)	27.9 (9.3)	$t(214) = -1.0$, $p = .33$, $d = .23$	34.0 (10.6)	27.6 (9.1)	$t(18.37) = -2.5$, $p = .02$, $d = .66$
Depressive Symptoms, *M* (*SD*)	9.8 (6.4)	5.9 (4.8)	$t(33.08) = -3.1$, $p = .004$, $d = .68$	10.2 (6.9)	6.0 (4.8)	$t(21.01) = -2.7$, $p = .01$, $d = .71$	11.1 (6.9)	6.0 (4.8)	$t(17.40) = -2.9$, $p = .01$, $d = .84$
Anxiety Symptoms, *M* (*SD*)	35.6 (8.4)	30.3 (6.8)	$t(34.08) = -3.3$, $p = .003$, $d = 0.70$	36.2 (8.6)	30.5 (6.9)	$t(21.61) = -2.9$, $p = .01$, $d = .74$	37.8 (8.9)	30.4 (6.8)	$t(17.64) = -3.3$, $p = .004$, $d = .94$

Note. Differences between those reporting LOC presence versus LOC absence within each group tested using independent samples *t*-tests or Pearson's Chi-square tests, as appropriate. EDE = Eating Disorder Examination. LOC = Loss of control. QEWP-C-5 = Questionnaire on Eating and Weight Patterns-5 Children/Adolescent. LOC-ED-Q = Loss of Control Eating Disorder Questionnaire. BMI*z* = BMI *z*-score.

[†]Un-transformed means and standard deviations are shown.