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Binge Eating Disorder and Associated Behaviors in Children and Adolescents: A Systematic Review of Measures

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Abstract

Background: It is concluded that binge eating (BE) is a common and prevalent problem among a sub-group of overweight children and adolescents. Assessment of BE symptoms among the pediatric population is important for prevention and treatment.

Objective: The aim of this review was to identify and analyse available self-report questionnaires designed to measure Binge Eating Disorder (BED) and associated behaviours in children and adolescents. **Methods:** A systematic review of English and Norwegian articles using MEDLINE and PsycINFO. The process was executed in two main steps by two independent reviewers: (1) Identification and selection of relevant measures in regard to the inclusion and exclusion criteria through searching the databases and (2) assessment of how well the selected questionnaires captured the DSM-5 criterias for BED (questionnaires developed for adults were excluded in this step). **Results:** 1423 records was screened and 96 articles met the inclusion criteria. A total of 36 measures were identified. Twelve questionnaires were selected and further analysed using the DSM-5 criteria for BED. Two questionnaires were found to capture the core criteria for BED, the Questionnaire of Eating and Weight Patterns-Adolescent (QEWP-A) and Youth Eating Disorder Examination-Questionnaire (YEDE-Q). **Conclusion:** There is wide range of different measures available, few fully assess the DSM-5 criteria for BED. According to the analysis, QEWP-A and YEDE-Q appear most suitable. A suggestion for future research is to develop a new questionnaire specifically for assessment of BED in the pediatric population. Limitations are discussed.

Key Words: binge eating, binge eating disorder, self-report, questionnaire, measure

Sammendrag

Bakgrunn: Det er konkludert med at binge eating er et vanlig og utbredt problem blant en undergruppe av overvektige barn og ungdom. Kartlegging av binge eating-symptomer blant den pediatriske befolkningen er viktig for forebygging og behandling av lidelsen. **Formål:** Formålet med denne litteraturgjennomgangen var å identifisere og analysere tilgjengelige spørreskjemaer utviklet for å måle Binge Eating Disorder (BED) og relatert atferd hos barn og ungdom. **Metode:** En systematisk gjennomgang av engelske og norske artikler i MEDLINE og PsycINFO. Prosessen ble utført i to hovedtrinn av to uavhengige forskere: (1) Identifikasjon og valg av relevante studier i forhold til inkluderings- og ekskluderingskriteriene ved å søke i databasene og (2) vurdering av hvor godt de utvalgte spørreskjemaene fanget opp DSM-5 kriteriene for BED. **Resultat:** 1423 artikler ble funnet og 96 oppfylte inkluderingskriteriene. Totalt 36 kartleggingsinstrumenter ble identifisert. Tolv spørreskjemaer ble valgt og analysert videre ved bruk av DSM-5-kriteriene for BED. Kun to spørreskjemaer ble funnet å fange opp kjerne-kriteriene for BED: QEWP-A og YEDE-Q. **Konklusjon:** Det finnes et bredt spekter av ulike kartleggingsinstrumenter, men få kartlegger DSM-5-kriteriene for BED fullstendig. Ifølge analysen fremstår QEWP-A og YEDE-Q som mest egnet. Et forslag til fremtidig forskning er å utvikle et nytt spørreskjema spesielt for vurdering av BED i den pediatriske befolkningen. Begrensninger diskuteres.

Nøkkelord: binge eating, binge eating disorder, selvrapporing, spørreskjema, måling.

Binge Eating Disorder and Associated Behaviors in Children and Adolescents: A Systematic
Review of Available Measures

Obesity in children and adolescents has been increasing the last decades and is considered a global health problem (Ng, et al. 2014). Understanding the multiple factors involved in obesity and weight gain is crucial to improve prevention and optimize treatment effectiveness. It is concluded that BE is a common and prevalent problem among a sub-group of overweight children and adolescents (Decaluwé and Braet, 2003; Glasofer et al., 2007; He, Cai and Fan., 2017) and further, that this sub-group of children with obesity might need a different treatment focus than those without binge eating (Fairburn and Harrison, 2003). There is a number of self-report questionnaires that assess different aspects of body image and disturbed eating behavior in children and adolescents, yet it is unclear to what extent these are in accordance with the diagnostic criteria for BED. In this paper we will browse this topic by: (1) Reviewing available measures used to target eating behaviors related to BED in the pediatric population, (2) identify which measures are the most used in studies of BED and associated behaviors in children and adolescents, and (3) assess which questionnaire that might be useful when screening for BED by the Diagnostic and Statistical Manual of Mental Disorders 5th edition (DSM-5) criteria (American Psychiatric Association, 2013).

Binge Eating Disorder

Binge eating disorder is a relatively new diagnosis and the most common eating disorder in adults (Spitzer et al., 1993). Adults with BED tell in retrospect that their symptoms already started in childhood (Abbot et al., 1998; Mussel et al., 1995). Yet it is rare for children to be diagnosed with BED, thereby making treatment recommendations challenging and leading to possible underdiagnosis (Decaluwé and Braet 2003, Goldschmidt et al., 2008). Symptoms of BED at a young age have been shown to be related to both obesity development, risk of developing eating disorders (ED), impaired quality of life and mental health (Fairburn, Cooper and Shafran, 2003; Marcus and Kalarchian, 2003; Spitzer et al., 1993; Tanofsky-Kraff et al., 2009). Research and clinical experience indicate that traditional weight-loss interventions may be contradictory when it comes to obesity with co-morbid BED, because individuals suffering from ED also needs psychological treatment targeting the specific cognitive-, emotional and behavioural eating disorder symptoms (Fairburn et al., 2003). Further, weight reduction and restrictive eating are for instance considered as possible maintaining factors for ED in the cognitive behavioral model of ED, and weight stabilization is recommended for those in treatment for BED (Wilson and Fairburn, 1993).

Diagnostic Criteria for BED

Binge eating behavior was first described by Stunkard in 1959, who recognized BE as a particular eating pattern among a sub-group of obese patients (Stunkard, 1959). Diagnostic criteria for BED was proposed in the early 1990's to describe people who had recurrent problems with binge eating but did not suffer from compensatory behavior (Spitzer, et al., 1992). BED gained full recognition as a distinct diagnosis by The American Psychiatric Association (APA) in the DSM-5. The key diagnostic features for BED in DSM-5 is; when

objectively large amounts of food is consumed until uncomfortably full, with a sense of loss of control (LOC), at least once a week over a 3 month period of time. LOC refers to the subjective experience of losing control over food intake, regardless of the amount of food being consumed (Tanofsky-Kraff, Marcus, Yanovski and Yanovski, 2008). Binges are usually not related to physical hunger, and compensatory behavior such as purging and exercise does not occur. Binging episodes are often followed by psychological distress regarding the binging, and marked feelings of shame and guilt (American Psychiatric Association, 2013) Obesity is not a criterion of BED because the disorder occurs both in individuals who are normal weight and obese (Bruce and Wilfley, 1996). The diagnostic criteria currently recommended for BED is presented in Table 1.

Table 1 about here

Prevalence of BED

BED was recently introduced as a distinct diagnosis, and there is limited data on prevalence of BED in the general pediatric population. A review by Marzilli, Cerniglia and Cimino (2018) found that prevalence rates for BED among adolescents were reported in 13 studies, five reported using DSM-4 criteria and eight using DSM-5 criteria. Prevalence rate ranging from 1% to 5%, indicating that BED is common and prevalent in adolescence. Available data suggests that 25% to 50% of adult obese patients who seek weight-loss treatment suffer from problems with BE (Bruce and Wilfley, 1996), and studies points to similar findings among a sub-group of obese children and adolescents seeking treatment for their obesity. (Spitzer et al. 1993, Decaluwé et al. 2003, He et al., 2017, Järholm et al., 2018). Decaluwé and Braet (2003) found that out of a subgroup of 126 children and adolescents seeking obesity treatment, 36.5% reported bingeing episodes. Only 1% of the subjects met the criteria required for a diagnosis of BED (Decaluwe and Braet 2003).

Järvholm et al. (2018) found that 37% of the adolescents seeking gastric bypass surgery reported BE before undergoing surgery. A meta-analysis by He et al. (2017) that included thirty-six studies with an aggregated sample size of 9818 children and adolescents with overweight and obesity (age range of 5–21 years old) showed that binge/LOC eating were present in one quarter of the total sample. A higher prevalence of binge eating was found for treatment-seeking participants (26.0%) than non-treatment-seeking participants (20.8%) (He et al., 2017). Allen and colleagues (2008) investigated the prevalence of binge eating and overeating in 259 children between the ages of 8- to 13- years old. 9 % of the sample reported binge eating. Obese children were most at risk for these behaviors (Allen, Byrne, La Puma, Mclean, Davis, 2008). In summary, evidence suggests a strong link between obesity and BE. Although it is uncommon that children meet the diagnostic criteria for BED, BE and LOC-eating appears to be prevalent in childhood (Decaluwé et al. 2003; Tanofsky-Kraff, Marcus, Yanovsky and Yanovsky, 2008; Tanofsky-Kraff, Faden, Yanovsky, Wilfley and Yanovsky, 2005).

Development of BED

As other eating disorders, BED is a result from an interplay between biological, psychological and cultural factors (Fairburn and Harrison, 2003). Retrospective studies investigating the risk factors for BED, have suggested that BED in adulthood is associated with exposure to risk for psychiatric disorders in general (e.g childhood trauma and parental depression), and to exposure of risk for obesity in childhood (Fairburn et al., 1998). Furthermore, that untreated BED is a stable syndrome maintained by several psychopathological processes (Fairburn, Cooper and Safran, 2003; Pope et al., 2006).

Clinical symptoms of BED typically do not emerge until adolescence, are more common in girls than in boys, and are often seen in relation of elevated weight and eating

concerns, as well as dietary restraint and depressive symptoms (Stice, Killen, Hayward, & Taylor., 1998; Vogeltanz-Holm et al., 2000; Stice, Presnell, Spangler, 2002). However, in some individuals the onset of LOC-eating episodes emerges during middle childhood and existing literature suggests that these individuals may be at higher risk of obesity and development of BED at an early age (Tanofsky-Kraff et al., 2004; Tanofsky-Kraff et al., 2009). Thus, one can distinguish between two groups; one group where the onset of dieting occurs before onset of before BE; a second group where the onset of BE occurs without dieting (Spurrell, Wilfley, Tanofsky and Brownell, 1997; Manwaring et al., 2006; Tanofsky-Kraff et al., 2008; Chamay-Weber, Combescure, Lanza, Carrard, and Haller, 2017). Theoretically, food restriction increases the probability that an individual will lose control over their food intake, and research have identified a significant relationship between onset and maintenance of BE and restriction (Stice, Burger and Yokum, 2013). In younger children however, binge and LOC-eating are not likely to be associated with marked efforts of restrictive food intake. For example, Tanofsky-Kraff investigated the self-reported relationship between dieting, BE and overweight among 100 children and found that dieting preceded LOC eating in only one third of the sample (Tanofsky-Kraff et al. 2005). Another study by Morgen et al. (2002) evaluated LOC-eating in a community based sample of 119 overweight children, and results showed no association between reported attempts to diet and episodes of LOC-eating. Tanofsky-Kraff et al. (2011) found that among a sample of non-treatment seeking children aged 6-13, children who reported LOC-eating at baseline were significantly more likely to have developed partial or full-syndrome BED at follow-up 5 years later compared to children who had never experienced LOC (Tanofsky-Kraff, et al. 2011).

Binge eating is further associated with psychiatric comorbidity (Glasofer et al. 2007; Goossens, Braet, Decaluwe, 2007; Hilbert et al. 2011). Research have suggested that obese individuals with BED are more likely to have an additional psychiatric disorder compared to

obese individuals without BED (Grilo, White and Masheb, 2009; Yanovski, Nelson, Dubbert and Spitzer, 1993). Longitudinal data indicate that symptoms of BE and LOC-eating in childhood are related to elevated symptoms of anxiety, as well as symptoms of depression (d'Autume, Musher-Eizenman et al., 2012; Glasofer et al. 2007; Goossens, Braet and Decaluwe, 2007; Tanofsky-Kraff et al., 2011; Stice, Hayward, Cameron, Killen and Taylor, 2000). Binge eating and depressive symptoms may interact reciprocally to maintain binge eating behaviors (Presnell, Stice, Seidel, and Madeley, 2009). The hedonic experience of a binge may provide a momentary relief of negative affective states (Berg et al., 2015) or serve as an “escape” from self-awareness (Heatherton & Baumeister, 1991), which ultimately promotes worsening of mood (Barker, Williams and Galambos, 2006). Relatedly, other behaviors such as eating in the absence of hunger (EAH), eating in response to negative affect, and the tendency to use food to regulate emotions has shown to be significant in predicting later BE (Johnson, Grieve, Adams and Sandy, 1999; Steinberg et al., 2004; Perpina, Cebolla, Botella, Lubre and Torro, 2011; Kelly et al., 2015).

Social factors and cultural factors are also thought to influence the developmental course of BED. Weight consciousness, weight-concern and weight-based stigma has been shown to predict later binge eating and has consistently been associated with overweight status in both adult and children (Ashmore, Friedman, Reichmann and Musante, 2008). Subjects diagnosed with BED often reports about repeated exposure to negative comments in childhood about shape, weight, and eating compared to controls (Fairburn et al., 1998), suggesting that psychological distress associated with stigmatization about weight may serve as a mediating factor in BED (Ashmore et al., 2008). Further, the context of a child's eating experience, is largely influenced by their parents, and parental attitudes and maternal feeding style has been used as a marker to predict eating behavior and weight-gain (Birch and Davison 2001; Faith, Scanlon, Birch, Francis and Cherry, 2004). For example, parental

restriction of palatable foods is associated with increased consumption of restricted foods, as well as eating in the absence of hunger and diminished self-regulation over food-intake (Carper, Fisher and Birch, 2000; Fisher and Birch 1999). In general, high level of parental control, is associated with poorer regulation of hunger and satiety and higher overweight status in children (Brown 2014; Rodgers, Paxton et al. 2013).

Assessment of Binge Eating

Binge eating is diagnostically important for ED. Failure to recognize and treat BED appropriately increases the risk for the disorder developing into a potential chronic state (Sheehan and Herman, 2015; Pope et al., 2006). There is a need for efficient and straightforward methods to screen for ED in both in clinical settings and in research, and various measures have been developed to meet this need. Generally, clinical interview is recommended when clinically diagnosing, and self-report should only be used for screening purposes (Decaluwé and Braet 2004). For example, interviews are interactive, which allows the assessor to explain questions and concepts. In addition, special care is taken and examples are provided. Consequently, the concepts and questions may be better understood by the subject. Questionnaires usually have lower sensitivity, and self-report questionnaires of eating disorder assessment do not accurately reflect the results of a structured interview (Wilfley, Schwartz, Spurrel and Fairburn, 1997). Among semi-structured interviews to assess eating pathology in children, the Children's Eating Disorder Examination (ChEDE) (Bryant-Waugh, Cooper, Taylor and Lask, 1996) is considered gold standard. However, interviews like ChEDE are time consuming and comprehensive, thereby not always suitable for screening for ED's in primary health care. Furthermore, to administer the clinical interview, professional training is required. The benefits of using questionnaires are that they are brief, economic, easily administered and scored (Tanofsky-Kraff et al., 2005). Primary care play an

important role in screening for different somatic- and psychological conditions, and given the limited time primary doctors have with their patients, there is a need for effective and valid questionnaire to screen BED (Birgegård, Norring, and Clinton, 2014).

Questionnaires could be a reasonable alternative for assessing binge/LOC eating, especially when considering the substantially higher cost of interview approach for such assessment purpose. He et al. (2017) found that there was no significant difference in reported prevalence rate of binge/LOC-eating in studies that used either interviews or questionnaires. However, it is important to ensure that children understand the questions they are answering, thorough clarification of the definition of the eating disorder features is therefore essential when using a self-report questionnaire with children. The subjective nature of a binge eating episode and the fact that children and adolescents mainly experience LOC eating, make the diagnosis particularly difficult to assess (Decaluwé et al. 2003; Tanofsky-Kraff, et al., 2005; Tanofsky-Kraff et al., 2008). Questions asked on assessment questionnaires are often adapted for child use from adult forms, and may not be readily understandable to children. Children may also have difficulties with providing the information required to meet the diagnostic criteria, as providing such information requires some degree of abstract thinking and understanding of one's eating behavior. Children may not be able to provide accurate quantification of the amount they eat. They may not understand the concept of 'objectively large amount of food', or what amount of food is defined as 'larger than most people would eat in a similar period of time under similar circumstances' that is seen as 'objective' may vary among children.

The Current Study

There is a need for suitable measures that assess symptoms of BED in the pediatric population, and to our knowledge no other paper have offered a systematic review of such

measures. Our aim with this review is to answer the following questions: (1) Which available measures are designed to target BED and associated eating behaviors in children and adolescents?; (2) which of these measures are the most used in studies of BED and associated behaviors in children and adolescents? and; (3) How well does the questionnaires developed for a child and adolescent population capture the DSM-5 criteria for BED?

Methods

Methods followed the principles presented by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Liberati et al., 2009). This systematic review was conducted in two main steps. The first main step was to identify and select relevant measures in regard to the inclusion and exclusion criteria. This was carried out by (1) identifying relevant articles through searching databases and (2) to identify measures used to assess BED in children and adolescents by reviewing abstracts, and (3) to select relevant questionnaires and included studies by manually reviewing the full texts. The second main step was to analyse the selected questionnaires. This was achieved by assessing how well the concepts/items of the questionnaires capture the DSM-5 criterias for BED.

Eligibility Criteria

Articles that met the inclusion criteria in the first main step were (1) written in English or Norwegian, (2) focusing on children or adolescents (<17) and (3) were an original research study that presented an eating behavior measure being used as a part of the methodology of the study. Studies focusing on both clinical (obese/overweight, diabetic, eating disorder) and general (students, communities) populations were included. Articles that did not specify which measure that had been used in their abstract (for example: “a measure assessing BE symptoms were used”) were excluded. Animal studies, studies of adults, review articles, book

chapters, unpublished works and articles written in a language not mastered by the two reviewers were excluded. For the second main step (the analysis comparing questionnaires to DSM-criteria), inclusion criteria were that the measure was a questionnaire (self report or parent report) that was originally developed for use with children or adolescents.

Study Selection

Two reviewers screened the articles (title and abstract) in regard to the inclusion and exclusion criteria. Differences in inclusion/exclusion of articles were resolved by discussion. Full texts were collected and analysed for the remaining articles by the same reviewers.

Information Sources and Search

Searches within two databases was completed (*Medline* and *PsycINFO*). Eligible studies were found by organizing the keywords in two main categories. The first category was designed to identify the target population, consisting of the following search criteria: “binge eating”, “binge eating disorder”, “emotional eating”, “overeate*”, “compulsive eating”, “out of control eating”, “uncontrol* eating”, “overspising”, “emosjonelt styrt spising”, “affective eating”, “eating in affect”, “impulsive eating” and “food addiction”. The other category was designed to identify the tools used to assess the characteristics of this population (“assess*”, “self-report*”, “interview*”, “screen*”, “questionnaire*”, “measure*”, “examination”, “inventory”, “test*”, “scale”). A third category was added to focus the search on articles about the age-specific group relevant for this review, using keywords such as “youth”, “child*” and “adolescent*”. The search was limited to articles published after 1994, where at least one of the keywords from each category were present in title or abstract. The same search strategy was used within both databases and was carried out October 4th 2017. A

supplementary search was conducted May 12th 2018 to obtain studies describing the psychometric properties of the identified questionnaires.

Data Items

The data derived from the selected studies (see Appendix) were information about the target population (community or clinical), sample size, mean age, gender and information about how many in the sample that were classified as overweight or obese. The data collected about the identified measures (presented in table two and three) were the name of the measurement, a brief presentation of the main goal/aim of the measurement, number of times used (in our sample), number and name of the subscales, number of items, if the measure was developed as a self-report or a parent report, target population and if the measure is considered specific for assessing BED, or general ED.

Results

Study Selection

The initial search in MEDLINE and PsycINFO resulted in 1953 articles with 1423 records remaining after the duplicates were removed. A total of 96 articles from the main search met the inclusion criteria. The most common reason for exclusion was that studies did not report a specific questionnaire in the abstract (N=141), that they used an adult sample or that the article was not written in English or Norwegian. Another common reason for exclusion was that the articles were not written in English. A total of 23 extra articles were included after an additional search, most of them were the original articles describing the development of the selected questionnaires. A total of 115 studies have been included in this review. The process of selecting studies is described in Figure 1.

Figure 1 about here

After the initial screening, a total of 36 measures were identified, 24 of these were excluded. There were five reasons for excluding measures: (1) the measure was originally developed based on an adult target population (N=16), (2) the measure was an interview (N=3), (3) the original article describing the validation of the instrument was not written in a language mastered by the researchers (N=2), (4) the article had not been published in a scientific journal (N=2) or (5) missing information about the instrument (N=1). Of the excluded measures, the most commonly used were interviews such as the Eating Disorder Examination (EDE) (N=28), Eating Disorder Inventory (N=24) and the Children's Eating Disorder Examination (ChEDE) (N=22). The most widely used of the excluded questionnaires were the Dutch Eating Behavior Questionnaire (DEBQ) (N=22) and the Eating Attitudes Test (EAT-26) (N=20). Table 2 and Table 3 describes the number of research studies using the different measures. See Table 2 for a description of all the excluded questionnaires/measures.

The remaining 12 questionnaires were: Child Feeding Questionnaire (CFQ), (Birch et al., 2001). Childrens Eating Behaviour Questionnaire (CEBQ), (Wardle, Guthrie, Sanderson and Rapoport, 2001). Dutch Eating Behavior Questionnaire for Children (DEBQ-C), (van Strien and Oosterveld, 2008). Questionnaire of Eating and Weight Patterns Adolescents (QEWPA), (Johnson, Grieve, Adams and Sandy, 1999). Eating Attitudes Test - Children (ChEAT), (Maloney, McGUIRE and Daniels, 1988). Eating Behaviour and Body Image Test (EBBIT), (Candy and Fee, 1998). Eating in Absence of Hunger Questionnaire (EAH-Q), (Tanofsky-Kraff et al., 2008). Eating Pattern Inventory for Children (EPI-C), (Schacht, Richter-Appelt, Schulte-Markwort, Hebebrand and Schimmelmann, 2006). Emotional Eating Scale for Children and Adolescents (EES-C), (Tanofsky-Kraff et al., 2007). Kids Eating

Disorder Survey (KEDS), (Childress, Jarrell and Brewerton, 1993). Minnesota Eating Disorder Inventory(M-EDI)/Minnesota Eating Behavior Survey (MEBS), (von Ranson, Klump, Iacono and McGue, 2005) and Youth Eating Disorder Examination Questionnaire (YEDE-Q), (Goldschmidt, Doyle and Wilfley, 2007). Of the 12 questionnaires that were selected for analysis, 7 were identified as “general” and 5 as “specific”. The general questionnaires are developed to assess problematic eating behaviour, factors associated with problematic eating behaviour or symptoms of eating disorders in general. The specific questionnaires are developed to assess BED or have at least some items that focus on assessing BE behaviour. Detailed description of the included questionnaires is presented in Table 3.

Study Characteristics

For a detailed description of the included studies, see Table 4 in Appendix A.

Questionnaire Characteristics

 Table 2 about here

 Table 3 about here

Analysis of Included Questionnaires

The second main step of this review was to investigate how well the questionnaires capture the DSM-5 criteria for BED. It was considered of interest to analyse both the questionnaires that was known by the researchers to be developed with the aim to assess symptoms of BED as well as the ones that did not have this particular focus. Two researchers

individually analysed each questionnaire, results were then compared and discussed. A “+” mark was given for each diagnostic criteria that was clearly represented and a “?” mark if a diagnostic criteria was partly represented. See Table 5 for results of the analysis. Table 6 presents an overview of the DSM-5 criteria and the questionnaires found to capture them.

Table 5 about here

Out of all included questionnaires, six questionnaires were found to have items that assess some of the DSM-5 criteria for BED. Only one questionnaire captured all diagnostic criteria, namely the QEWP-A (Johnson et al. 1999). The QEWP-A was developed exclusively for the identification of BED in the adolescent population. The questionnaire consists of 13 items that focus directly on the behavioral criteria of BED, such as the amount of food eaten, the duration of eating episodes, and the experience of LOC while eating. The QEWP-A is quickly administered and scored and classifies respondents with BED and bulimia nervosa (Yanovski 2015; Spitzer, 1992). Respondents are asked to specify the amount of food consumed, which helps to distinguish between objective and subjective binge episodes. The questionnaire also assess the experience of LOC, “Think about a usual time when you ate a REALLY BIG amount of food and felt you could not control your eating” and “As best as you can remember, please list everything you ate or drank during this time. Be specific - include brand names where possible, and amounts as best you can guess” (Johnson et al, 1999).

The YEDE-Q (Goldschmidt et al., 2007) is a version of EDE-Q adapted for adolescents designed to assess the full spectrum of eating disorder psychopathology, and classifies children on YEDE-Q contains four subscales and a global scale. The YEDE-Q was found capture four diagnostic criteria, the first one was the the A1-criteria, which is represented by the following item; “Over the past 28 days have there been times when you

have eaten a really big amount of food, compared to what other kids your age would eat in the same situation?”. The YEDE-Q also captures the The A2-criteria, namely LOC-eating, which is clearly represented by item 8: On how many of the past 28 days have you binged (eaten a really big amount of food and felt that you had lost control over your eating)? (circle one)”. The B4-criteria is represented by item 9: “ Over the past 28 days, how many days have you eaten in secret? Do not count binges”. The D-criteria was found to be fulfilled. Respondents are asked to indicate the frequency of the binge and LOC-eating. The E-criteria is represented by items that map the presence of compensatory behavior (which can be assessed through the subscales for anorexia and bulimia).

The EBBIT (Candy and Fee, 1998) was developed to measure body image satisfaction and eating behaviors associated with eating disturbance in pre-adolescent girls. The EBBIT measures body dissatisfaction, restrictive eating and binge eating behaviors. The A1-criteria was partly fulfilled. Questions like “I collect food in my room and sometimes eat it all at once”; “I eat all of my Halloween candy at once”; “I eat a lot of food all at once”, does not allow the respondent to make answers that can be used to identify if the amount of food eaten is an 'objective large amount of food'. Four out of five sub-criteria of the B-criteria was represented (2, 3, 4 and 5). Also, the C-criteria was found to be partly fulfilled, one example of an item that partly assess this criteria is; “I feel really bad after I eat a lot of food”. Items assessing the E-criteria were not sufficiently covering the full range of compensatory behavior (mostly focused on diet behavior like skipping meals and exercising after eating a lot of food).

The MEBS (von Ranson et al. 2005) is a 30-item questionnaire designed to assess behavioral and attitudinal symptoms associated with anorexia nervosa, bulimia nervosa, and BED, in both children and adults. MEBS measures body dissatisfaction, compensatory behavior, binge eating and weight preoccupation. The A2 criteria (LOC-eating) was represented by: “Sometimes I eat lots and lots of food and feel like I can’t stop”, the same

applies to two out of five B-criteria that were captured by; “Sometimes I eat by myself so that others won’t know what I’m eating” (B4), “I feel very guilty after I overeat” (B5). Finally, the E-criteria were found to be fulfilled.

KEDS (Childress et al., 1993) was developed to screen for symptoms of ED and address developmental differences among children and adolescents by the use of simple language and drawings. KEDS consists of 12 items answered either “yes” or “no”. The A1-criteria was fulfilled. Respondents are asked to draw circles of examples of amount of food, e.g “Eight doughnuts and half a gallon of ice cream”. Respondents are also asked to report how many times bingeing have occurred, thus, E-criteria were fulfilled.

ChEAT (Maloney et al., 1988) is a 40-item, forced-choice questionnaire. ChEAT was designed to measure behaviors and cognitions associated with eating disturbance, in addition to measure clinical symptoms of anorexia and bulimia. The A2-criteria (LOC-eating) was found to be fulfilled by items like; “I have gone on binges where I feel like I might not be able to stop” and “I can show self-control around food”.

Table 6 about here

Discussion

Findings

There is a number of different measure that assess eating behavior in children and adolescents. Our aims was to (1) offer a systematic review of existing measures that target BED and associated eating behaviors, (2) to identify which measures are the most used in research and (3) to investigate how well the selected self-report questionnaires fit the DSM-5 criteria for BED. We consider our sample to be representative for this purpose.

Initially, the findings of this comprehensive review identified 36 different measures, indicating that there is a variety of different measures currently available that might be more or less related to the development of behaviors associated with BED, and to actual symptoms of BED. ‘Gold standard’ interviews such as EDE, EDI and ChEDE were frequently reported in the total sample, the former mostly in studies focusing on adolescents, the latter in studies focusing on children down to the age of 10. The most frequently reported measure in our total sample was the CEBQ (N=37), which is a parent-report questionnaire. Studies reporting having used the CEBQ focused on a population of children under the age of 10, indicating that parent-reports are often applied in eating behavior studies focusing on younger children.

Twelve questionnaires (after interviews and questionnaires developed for adults were excluded) were included in further analysis to see how well they captured the DSM-5 criteria for BED. This process was relatively straight forward, comparing the items of the questionnaires to the criteria listed in the DSM-5 manual. Five of the questionnaires were specifically developed for screening of symptoms associated with eating disorders, and included subscales or items for BE (ChEAT, QEWP-A, MEBS, YEDE-Q and KEDS); only one were developed exclusively for assessment of BED by DSM-5-criteria, namely the QWEP-A. The remaining questionnaires were not developed specifically to assess BE or BED.

According to the DSM-5, diagnostic criteria for BED (see Table 1 and Table 6) include recurrent episodes of binge eating, namely eating objectively large amounts of food in a short period of time (A1), and a sense of lack of control overeating during the episode (A2). At least 3 of 5 additional criteria also needs to be fulfilled (e.g eating large amounts when not feeling physically hungry, eating alone due to embarrassment). The binging is followed by significant distress regarding, and not followed by compensatory behavior (e.g restriction, exercise or use of laxatives). The BED diagnosis requires that both the A1 and A2 criteria is

met. The A1-criteria was only found to be clearly represented by three questionnaires, namely QEWP-A, YEDE-Q and KEDS. This criteria may be particularly difficult to assess because it relies on the ability of retrospective recall (amount of food consumed), and that the child manage to provide information that can be used to determine if they are experiencing “Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances”. The A2-criteria “The sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)” relies on recall of subjective experience (LOC-eating) and an understanding of what ‘being out of control’ feels like. The QEWP-A, YEDE-Q, ChEAT and MEBS got a positive mark on the A2 criteria, indicating that LOC-eating might be an easier concept to measure or understand, compared to A1 criteria.

Only two questionnaires, namely QEWP-A and YEDE-Q were found to assess both the A1 and A2 criteria. Both of these questionnaires also captured additional criteria (B-criteria), frequency of the binge eating (D-criteria) and compensatory behavior (E-criteria) as well as the severity of the bingeing. The majority of the questionnaires did not have items specific enough to rule out or confirm diagnostic criteria. One example of this may be that clinical bingeing is characterised by “eating large amount of food in a limited period of time”, and most questionnaires did not have items defining 'a large amount of food', thus, making it impossible to distinguish between objective and subjective bingeing. Questions were typically unspecific and did not ask for information regarding the time aspect, for example “Sometimes I stuff myself with food” (MEBS), this question might well capture children with bingeing episodes, but the specificity in discriminating objective binge eating from subjective is not addressed. Also, there were questions that seemed to be cultural specific (e.g "I eat all of my halloween candy at once" in the EBBIT questionnaire).

Although both QEWP-A and YEDE-Q were found to assess the same amount of diagnostic criteria, they differ in many aspects. They differ in terms of presentation, language and clarification of concepts. Formulation of the items in the QEWP-A is similar to the diagnostic criterias, and therefore may not be readily understandable to children. Questions asked by the QEWP-A relies on recall of number and duration of bingeing episodes, and an understanding of what other people might consider a large amount of food, which may vary from individuals, families and cultures. The YEDE-Q appears to be more adapted for assessment of children; YEDE-Q provides drawings of 'a large amount of food' and 'a small amount' of food' and provides examples of 'really big amount of food' (BE), descriptions of 'being out of control' (LOC), as well as examples of bingeing and experiencing LOC at the same time.

Out of the 12 questionnaires, there was six questionnaires that did not fulfill any of the DSM-5 criteria for BED (CFQ, CEBQ, DEBQ-C, EAH-Q, EPI-C and EES-C). These questionnaires weren't developed to assess BED or BE, but are widely used in research and clinical settings to assess different psychological dimensions of eating behavior that relate to sub-threshold symptoms of BED. Behaviors such as eating in the absence of hunger, eating to regulate affective states and eating in secret or hiding food, may be correlates of BE in children.

Two different parent-reports that were part of the analysis were the CEBQ and the CFQ. The CFQ (Birch et al., 2001) was developed to assess parental beliefs, attitudes and practises regarding child feeding, and how these are related to obesity proneness in children. CFQ measure parents concerns about their child's risk for obesity and parents use of controlling feeding practises, which has been associated with disinhibited eating and increased risk for weight-gain (Carper et al., 2000; Fisher and Birch 1999). The CEBQ (Wardle, Guthrie et al. 2001) was designed to measure children's eating style as reported by

their parents. CEBQ is widely used in research investigating the early signs of ED or obesity. CEBQ assess eight dimensions of eating style in children: Food responsiveness, Emotional overeating, Enjoyment of food, Desire to drink, Satiety responsiveness, Slowness in eating, Emotional undereating, and Food fussiness. As mentioned, CEBQ contains two subscales on emotional eating. The relationship between eating behaviour and emotions is widely studied, and many of the questionnaires in our sample (DEBQ-C, EAH-Q and EPI-C) have subscales focusing on emotional eating, both undereating and overeating. The EES-C is developed to assess eating in response to various emotions, both positive and negative, which have been associated with binge and LOC-eating (Tanofsky-Kraff et. al, 2007). Therefore, questionnaires focusing on the aspect of “emotional eating” might be of value when trying to collect information about BED. Another concept that has been posited to be an early indicator of disinhibited eating/LOC-eating in younger children is “eating in the absence of hunger” (Faith et al, 2006). One questionnaire in our sample was specifically designed to measure this behavior, namely the EAH-C (Tanofsky-Kraff, 2008).

Assessment of BED in Children

There are several challenges when it comes to assessing BED in children. An important aspect of assessment, is to obtain descriptions of person’s typical episodes of BE to ascertain their clinical significance. The diagnosis may be particularly challenging to assess in children due of its reliance of recall of binge episodes and subjective experience of LOC, as well as the ability to understand complex concepts such as “feeling guilty after eating”. Children may have difficulties with reporting how they are eating, and furthermore, may not have an understanding of what it feels like being out of control, and how they feel afterwards. There is some evidence that the manifestations of BED are different in children than what is observed in adults. Generally, symptoms of psychiatric disorders seem to express itself

differently in children and adults. Especially younger children are unlikely to exhibit the same type of symptoms as adults or even as adolescents. In relation to this, there has been great debate regarding the existing DSM-5 criteria's adequacy to appropriately assess BED in children. Some authors have made arguments of a more transdiagnostic approach and more flexible criteria when screening for ED among youths, as failing to adequately classify children and adolescents with ED poses difficulties in treatment recommendations (Decaluwé and Braet 2003; Limburg, 2018; Tanofsky-Kraff, 2008). Clinical studies have suggested that LOC-eating may be more important than the consumption of an objectively large amount of food in children (Decaluwé and Braet, 2003; Marcus and Kalarchian, 2003). In relation to this, Loss of Control Eating Disorder (LOC-ED) has been proposed as a diagnostic category by Tanofsky-Kraff and Marcus (2008) for children 6–12y with binge-type eating, emphasizing LOC-eating in combination with food seeking in the absence of hunger, and eating to regulate negative affect, secretively eating (Tanofsky-Kraff et al., 2008). In sum, it is possible that the cause of low rates of children, who meet the diagnostic criteria for BED, is due to the fact that children do not exhibit the same symptoms as adolescents and adults, or that they are at an earlier stage of the development of an eating disorder. Assessment of children requires age appropriate content and language to ensure comprehension, and it may also be that questions asked by interviews and questionnaires are not well adapted to children.

Limitations

In sum, this review revealed that there is a wide range of different measures available and that most of these measures have been used relatively few times each in our sample, considering the amount of records screened (N=1423). One limitation was the process of data collection. The articles were manually downloaded by two researchers to two separate computers, where the selection process was executed. Even though this process was

thoroughly carried out, there is still a risk for manual errors. Also, the access to relevant data has to some extent been limited by the researchers fluency in language (english and norwegian). Another limitation of the methodology of the study was how the selection process was influenced by the age of the populations in the reviewed studies. One of the inclusion criteria was that the study had to focus on children or adolescents (<17). Some studies presented a mean age around 17, which meant that the questionnaire had been used with a population that was both within and outside the range of the inclusion criteria. The process of deciding which studies that should be included/excluded based on the mean age of the population might have led to some unsystematic assessments. The review might have been influenced by cultural bias. In the analysis, two researchers evaluated whether or not the items in the questionnaires were formulated clearly enough to be able to collect the information that represented the diagnostic criteria for BED in the DSM-5 manual. Some questions are written to fit the language and culture where the questionnaire is developed, and might be interpreted differently by the researchers in this review than the population that it was meant to be used within.

Conclusion

Clinical and empirical evidence suggests that the emergence of ED may begin as early as middle childhood (Tanofsky-Kraff et al, 2004; Tanofsky-Kraff et al. 2009). There is a need for suitable self-report questionnaires that assess symptoms of BED on a continuum of severity, and that can be readily used with children. In addition to the assessment of actual symptoms of BED, there is also a need for appropriate measures to enable investigation and assessment of psychological dimensions of children's eating behavior and their impact on the development of ED and body weight. Our paper revealed that there are currently several different measures assessing eating behavior and symptoms related to BED in children and

adolescents. Many of the existing questionnaires for use within this age group are modified versions of measures originally developed for the adult population. Our paper also revealed that parent-reports are often applied in studies focusing on eating behavior in children under the age of 10. Further, that adult interviews are frequently used in studies of adolescents, possibly reflecting that there is a developmental gap between children and adolescents. Still, these questionnaires are used for an age group that they are not validated for. Although there is a wide range of questionnaires assessing psychological dimensions and behaviors related to BED, this review revealed that there are currently few questionnaires (developed for use with children and adolescents) that fully capture the DSM-5 criteria for BED. According to our sample, only one questionnaire focused exclusively on BED and fulfilled all diagnostic criteria, namely the QEWP-A. However, after completing the analysis and discussing the results, the reviewers considered that the YEDE-Q might be more appropriate when screening children for BED. YEDE-Q appears to be more adapted to children in terms of language and content. It is the only questionnaire in our sample that provide an explanation of terms and concepts that might be difficult for children to understand (for example “What is feeling out of control?” and “What is a really big amount of food?”). This combined with providing text examples of “a binge episode” as well as pictures of different amounts of food might help children estimate how large an amount of food, and provide more accurate information about their own eating. As a proposal for future research, development of questionnaires should (1) specifically focus on children’s developmental level to ensure comprehension of concepts and (2) be based on how symptoms of BED is expressed in children.

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Table 1

DSM-5 Diagnostic Criteria for Binge Eating Disorder

Criteria Set and Severity Grading	Specific Definitions for Each Criterion
Criteria A	<p>Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:</p> <ol style="list-style-type: none"> 1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances 2. The sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)
Criteria B	<p>Binge-eating episodes are associated with 3 or more of the following:</p> <ol style="list-style-type: none"> 1. Eating much more rapidly than normal 2. Eating until feeling uncomfortably full 3. Eating large amounts of food when not feeling physically hungry 4. Eating alone because of being embarrassed by how much one is eating 5. Feeling disgusted with oneself, depressed, or very guilty after overeating
Criteria C	Marked distress regarding binge eating is present.
Criteria D	The binge eating occurs, on average at least 1 day a week for 3 months.
Criteria E	The binge eating is not associated with the regular use of inappropriate compensatory behavior (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa.
Severity grading	<p>Mild: 1 to 3 episodes per week Moderate: 4 to 7 episodes per week Severe: 8 to 13 episodes per week Extreme: 14 or more episodes per week</p>

Table 2

Description of Excluded Questionnaires

Questionnaire	Goal	# Times used	# Sub-scales	# Items	Parent (P)/ Self-report (SR)	Target population	General (G)/ Specific (S)
Eating Disorder Examination Interview (EDE)	Assessment of specific eating pathology symptoms of eating disorders, including extreme concerns about shape and weight.	28	4 (Restraint, eating concern, shape concern and weight concern).	41	SR	Adult	S
Eating Disorder Inventory (EDI)	Assesses the presence of general eating disorder symptoms.	24	12 (Drive for Thinness, Bulimia, Body Dissatisfaction, Low Self-Esteem, Personal Alienation, Interpersonal Insecurity, Interpersonal Alienation, Interoceptive Deficits, Emotional Dysregulation, Perfectionism, Asceticism, and Maturity Fears).	91	SR	Adult	S
Dutch Eating Behavior Questionnaire (DEBQ)	Assess symptomatic types of eating.	22	3 (Restrained eating, emotional eating and external eating).	33	SR	Adult	G

Eating Disorder Examination Interview Children (ChEDE)	A version of the EDE interview adapted for children. Assesses diagnostic criterias of eating disorders.	22	4 (Restraint, eating concern, shape concern and weight concern).	-*	SR	Children & ADOL	S
Eating Attitudes Test (EAT-26)	Assesses symptoms of AN and BN. Gives indication to diagnosis.	20	3 (Diet Scale, Bulimia & food preoccupation, oral control).	26	SR	ADOL	S
Eating Disorder Examination Questionnaire (EDE-Q)	Assesses key attitudes and behavioral features of eating disorders.	19	4 (Restraint, eating concern, shape concern and weight concern).	28	SR	Adult	S
Binge Eating Scale (BES)	Assessing the presence/severity of binge eating behavior indicative of an eating disorder.	16	1 (Binge eating behaviour).	16	SR	Adult	S
Three Factor Eating Questionnaire (TFEQ)	Assesses for features of dietary restraint, LOC and hunger.	16	3 (Dietary restraint, disinhibition, hunger).	51	SR	Adult	S
Bulimic Investigatory Test Edingborough (BITE)	Assesses BN behaviors and is used to identify individuals with symptoms of BN or BED.	14	2 (Present symptoms, severity).	33	SR	Adult	S

Yale Food Addiction Scale	Assesses food addiction.	8	1 (Food addiction).	25	SR	Adult	G
Childrens Binge eating Disorder Scale (C-BEDS)	Screens for BED based on DSM-criteria.	5	1 (BE).	7	SR	Children	S
Eating Disorder Examination Questionnaire Children (ChEDE-Q)	Version of EDE-Q adapted for children. Assessment of eating disorder psychopathology.	4	4 (Restraint, eating concern, shape concern and weight concern).	28	SR	Children	S
Eating Disorders Diagnostic Scale (EDDS)	Assesses the presence of AN, BN and BED symptomatology aligned with the DSM-IV diagnostic criteria.	3	3 (AN, BN and BED).	22	SR	Adult	S
Body Shape Questionnaire (BSQ)	Assesses concerns about body shape, in particular the experience of “feeling fat”.	2	1	34	SR	Adult	G
Bulimia Test - Revised (BULIT-R)	Assesses the presence and severity of BN symptoms of BE and purging	2	1	28	SR	Adult	S
Food Reinforcement Value Questionnaire (FRVQ)	Assesses the reinforcement value of food based on the report of children in relation to their feeding behavior.	2	-	12	SR	Children	G

Motivation For Eating Scale (MES)	Assesses different reasons for initiating food consumption.	2	4 (Emotional, environmental, physical, and social eating).	43	SR	Adult	G
SCOFF Questionnaire	Screening tool for detection of a possible eating disorder, focuses on characteristics of AN and BN.	2	1	5	SR	Adult	G
Adolescent Binge Eating Scale	Prediction of BED diagnosis in adolescents seen for obesity.	1	1	10	SR	ADOL	S
Diagnostic Survey for Eating Disorders (DSED)	Collects information about eating and purging behaviours.	1	12 (Demographics, weight history & body image, dieting, BE, purging, exercise, related behaviors, sexual functioning, menstruation, medical and psychiatric history, life adjustment and family history).	-	SR	-	S
Eating Behaviour Questionnaire	-	1	-	-	-	-	-

Eating Disorder Evaluation Scale (EDES)	Assess both specific symptoms and broader psychosocial aspects of eating disorders.	1	4 (Anorectic preoccupation, bulimic behavior, sexuality and psychosocial adjustment).	22	SR	Adult	S
Emotional Binge Questionnaire	-	1	-	-	-	-	-
Weight Efficacy Lifestyle Questionnaire (WEL)	Designed to measure dimensions of situational eating self-efficacy.	1	5 (Availability, negative emotions, social pressure, physical discomfort and positive activities).	20	SR	Adult	G

Note. *information/data is missing.

Table 3

Description of Included Questionnaires

Questionnaire	Goal	# Times used	# Scales	# Items	Parent (P)/ Self-report(SR)	Target population	General (G)/ Specific (S)
Childrens Eating Behaviour Questionnaire (CEBQ)	Assesses dimensions of eating styles.	37	8 (Responsiveness to food, enjoyment of food, satiety responsiveness, slowness in eating, fussiness, emotional overeating, emotional undereating, and desire for drinks).	35	P	Children	G
Dutch Eating Behavior Questionnaire Children (DEBQ-C)	Assess eating behaviours.	14	3 (Restrained eating, emotional eating and external eating).	20	SR	Children	G
Child Feeding Questionnaire (CFQ)	Assesses parents beliefs, attitudes and practices regarding child feeding.	13	7 (Perceived responsibility, perceived parental weight, perceived child weight, concern about child weight, restriction, pressure to eat and monitoring).	31	P	Children	G
Eating Attitudes Test - Children (ChEAT)	A version of the EAT-26 test. Similar but uses simpler words.	9	4 (body/weight concern, food preoccupation, dieting and eating concern).	26	SR	Children	S

Emotional Eating Scale for Children and Adolescents (EES-C)	Assess the extent to which an individual eats in response to emotions.	7	3 (Depression, anger/anxiety/frustration and feeling unsettled).	25	SR	Children & ADOL*	G
Questionnaire of Eating and Weight Patterns Adolescents (QEWPA)	Assessment of criteria for BED and BN in the DSM-5.	7	1 (Binge eating).	12	P & SR	Children & ADOL	S
Eating In Absence of Hunger Questionnaire (EAHQ)	Is predictive of excess weight gain in children through assessing the construct of “eating in absence of hunger” (EAH).	6	3 (Negative affect, external eating, boredom/fatigue).	14	SR	Children & ADOL	G
Eating Behaviour and Body Image Test (EBBIT)	Measure body image satisfaction and eating behaviors and disturbances.	5	3 (Body image dissatisfaction and food restriction, binge eating behavior, compensatory behavior).	42	SR	Pre-ADOL	G
Eating Pattern Inventory for Children (EPI-C)	Assesses general psychological dimensions of eating behavior.	5	4 (Dietary restraint, external eating, parental pressure to eat, and emotional eating).	20	SR	Children	G

Minnesota Eating Behavior Survey (MEBS)	Assessing attitudes and behaviors symptomatic of eating disorders.	2	4 (Body Dissatisfaction, Compensatory Behavior, BE and Weight Preoccupation).	30	SR	Children & ADOL	S
Youth eating disorder examination questionnaire (YEDE-Q)	Assesses ED pathology.	2	4 (Restraint, Eating Concern, Weight Concern and Shape Concern).	39	SR	Children & ADOL	S
Kids Eating Disorder Survey (KEDS)	Assesses weight and body dissatisfaction.	1	2 (Weight Dissatisfaction, Purging/Restricting).	12	SR	Children	S

Note. *ADOL= Adolescents.

Table 5

Analysis of Selected Questionnaires

Questionnaire	Main concept/aim	A	B	C	D	E	Severity	N “+”
Child Feeding Questionnaire (CFQ)	Assess parent’s beliefs, attitudes and practices regarding child feeding.	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0
Childrens Eating Behaviour Questionnaire (CEBQ)	Assess dimensions of eating styles.	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0
Dutch Eating Behavior Questionnaire for children (DEBQ-C)	Assess children’s eating behaviors.	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0
Questionnaire of Eating and Weight Patterns - Adolescents (QEWPA)	Assess DSM-5 criteria for BED and BN.	1+, 2+	1+, 2+, 3+, 4+, 5+	+	+	+	+	11
Eating Attitudes Test-children (ChEAT)	Assess symptoms of and gives indication to diagnose AN and BN.	1-, 2+	1-, 2-, 3-, 4-, 5?	-	-	?	?	1
Eating Behaviour And Body Image Test (EBBIT)	Assess eating behavior and body image.	1?, 2-	1-, 2+, 3+, 4+, 5+	?	-	?	+	5
Eating In Absence of Hunger Questionnaire (EAH-Q)	Assess eating in absence of physical hunger	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0

Eating Pattern Inventory for Children (EPI-C)	Assess general psychological dimensions of eating behavior	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0
Emotional Eating Scale for Children and Adolescents (EES-C)	Assess the extent to which an individual eats in response to emotions.	1-, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	-	0
Kids Eating Disorder Survey (KEDS)	Assess weight and body dissatisfaction.	1+, 2-	1-, 2-, 3-, 4-, 5-	-	-	-	+	2
Minnesota Eating Behavior Survey (MEBS)	Assess attitudes and behaviors symptomatic of eating disorders.	1?, 2+	1-, 2?, 3-, 4+, 5+	?	-	+	-	4
Youth eating disorder examination questionnaire (YEDE-Q)	Assess eating disorder pathology.	1+, 2+	1-, 2-, 3-, 4+, 5-	-	+	+	+	6

Note. “+” Represents diagnostic criteria fulfilled; “?” represents partly fulfilled criteria and; “-” marks criteria not fulfilled.

Table 6

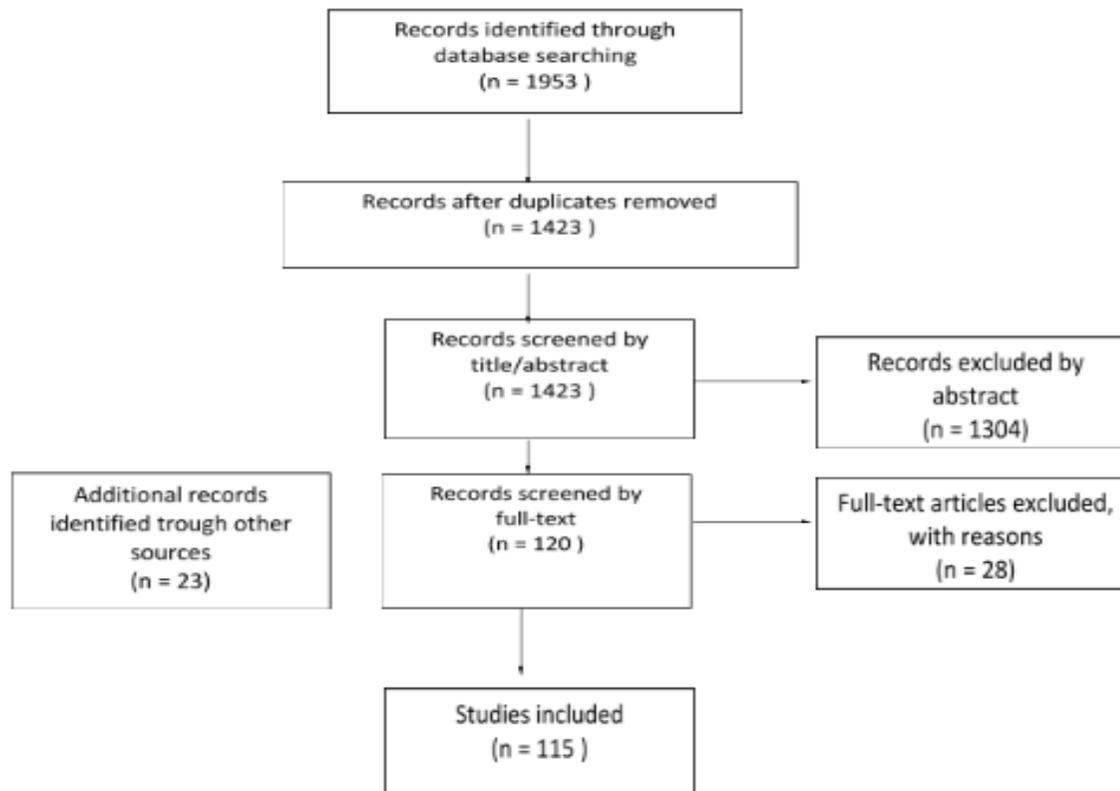
Result of Analysis Overview

Criteria Set and Severity Grading	Specific Definitions for Each Criterion	Questionnaire Assessing Criterion	Questionnaire Partly Assessing Criterion
Criteria A	Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:		
	<ol style="list-style-type: none"> 1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances. 2. The sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating) 	<ol style="list-style-type: none"> 1. QEWP-A, KEDS & YEDE-Q. 2. QEWP-A, ChEAT, MEBS & YEDE-Q. 	<ol style="list-style-type: none"> 1. EBBIT & MEBS. 2.
Criteria B	Binge-eating episodes are associated with 3 or more of the following:		
	1. Eating much more rapidly than normal	1. QEWP-A.	1.
	2. Eating until feeling uncomfortably full	2. QEWP-A & EBBIT.	2. MEBS.
	3. Eating large amounts of food when not feeling physically hungry	3. QEWP-A & EBBIT.	3.
	4. Eating alone because of being embarrassed by how much one is eating	4. QEWP-A, EBBIT, MEBS & YEDE-Q.	4.

	5. Feeling disgusted with oneself, depressed, or very guilty after overeating	5.QEWP-A, EBBIT & MEBS.	5. ChEAT.
Criteria C	Marked distress regarding binge eating is present.	QEWP-A.	EBBIT & MEBS
Criteria D	The binge eating occurs, on average:		
	1. At least 1 day a week for 3 months	1.QEWP-A, YEDE-Q	1.
Criteria E	The binge eating is not associated with the regular use of inappropriate compensatory behavior (e.g., purging, fasting, excessive exercise) and does not occur exclusively during the course of anorexia nervosa or bulimia nervosa.	QEWP-A, MEBS & YEDE-Q.	ChEAT & EBBIT.
Severity grading	Mild: 1 to 3 episodes per week Moderate: 4 to 7 episodes per week Severe: 8 to 13 episodes per week Extreme: 14 or more episodes per week	QEWP-A, EBBIT, & YEDE-Q.	ChEAT & KEDS.

Figure 1

Flowchart of the Process of Study Selection



APPENDIX

Table 4

Description of Included Studies

Measure/Article	Population/Samples	Sample Size(s)	Mean Age (M/SD)	% Girls	% Overweight/Obese (OW/OB)
Child Feeding Questionnaire (CFQ)					
Anderson et al. (2005)	1. Community (Black children); 2. Community (Hispanics children)	101; 130	4/0.7; 4.3/0.7	57.4%; 52.3%	28.7/52.5%; 40.8/35.4%
Birch et al. (2001)	1. Community; 2. Community; 3. Community	394; 148; 126	5-9; 8-11; 7-11	100%; 67%; 50%	- - -
Brown, A., & Lee, M. (2011)	Community	642	6-12mth	-	-
Burrows, T., et al (2017)	Community	150	8.2/2.3	49.33%	22/32.7%
Corsini et al. (2008)	Community	203	4.78/.19	45.83%	18.2/5.1%
de Barse (2015)	Community	4851	4y	59%	-

Ek, A., et al. (2015)	1.Community; 2.Clinical (OB)	432; 47	5.5/1.0 (Total sample)	52%	9.7/0.3%; 100%
Galindo, L., et al. (2017)	Community	138	5.4	46.4%	22.5/29%
Kaur et al. (2006)	Community	301	15/1.7	50%	21.9/26.3%
Kong et al. (2015)	1.Community (Hispanic); 2.Community (African American)	296; 666	3.7/0.9 (Total sample)	50.3%	23.2%; 13.3%
Liang, J., et al. (2016)	Clinical (OW/OB)	117	10.40/1.35	53%	100%
Matton, A., et al. (2013)	Community	613	9.05/.86	46.5%	-
Matheson, B. E., et al. (2015)	Clinical (OW/OB)	118	10.4/1.35	53.40%	100%
Monnery-Patris, et al. (2011)	1.Community; 2. Clinical (OB)	182; 58	10.2/0.53; 10.71/0.59	47.8%; 50%	-; 100%
Mosli, R. (2016)	Community (low income)	69	5.35/0.80	47.8%	-
Rhee K. E., et al (2015)	1. Community (Normal weight); 2. Community (OW/OB)	38; 41	9.7/1.4 (Total sample)	53; 66%	0; 100%

Tripicchio, G. L. et al. (2014)	Community (twins)	138	58.4/17.7 mths	-	-
Childrens Eating Behaviour Questionnaire (CEBQ)					
Anderson, C. B., et al. (2005)	1.Community (Black); 2.Community (Hispanic)	101; 130	4.15/0.71	55%	32.7; 32.7%
Ashcroft, J., et al. (2008)	Community (twins)	400	4.4/0.3	55.8%	-
Carnell et al. (2007)	Community (parents)	111	4-5y	49.5%	-
Croker, H., et al. (2011)	1.Community; 2.Clinical (OW)	406; 66 (total sample 472)	9.5y; 10.3y	54; 68%	15.3/ 4.9; 0/100%
Daniels, L. A., et al. (2014)	Community	698	4.03/ 1.0 mths	-	-
De Barse et al. (2015)	Community	4851	4y	51%	-
Demir, D., & Bektas, M. (2017).	Community	1201	-	50.6%	-
Disantis, K. I., et al A. (2011)	Community (low income)	109	4.1/0.1	-	23.8%
Domoff et al. (2015)	Community	1002	4.05/.53	51.4%	18.6/17%

Ek, A., et al. (2016)	1.Community; 2.Clinical (OB)	431; 47	5.5/1.0; 5.1/0.7	52; 53%	9.7/0.3%; 10/10%
Eloranta, A. M., et al. (2012)	Community	510	7.6/0.4	48%	-
Escobar, R. S., et al. (2014)	Community	196	4y	48%	-
Fox, C. K., (2016)	Clinical (OW)	102	15.3/1.87	67%	100%
Hardman, C. A., et al (2016)	Community	116	8.63	-	-
Herle, M., (2017).	Community (twins)	2402	T1:16 mths T2: 5yr	64%	-
Herle, M. (2017)	Community	2054	5.5/0.13	-	-0.22
Koch, A., & Pollatos, O. (2014).	Community	1657 1610	T1: 8.38/0.95 T2: 9.13/0.93	T1:52.1 % T2:51.9 %	?
Leventakou, V., et al. (2016)	Community	471	4y	48.6%	13.9/6.3%
Loh, D. A., et al. (2013)	Community	646	13y	73.2%	16/10.5%

Lumeng, J. C., et al (2014)	Community	331	3-4y	50%	36.2%
Mallan et al. (2013)	Community. 1.First-time mothers; 2.Immigrant Indian mothers; 3.immigrant Chinese mothers	244; 203; 216	24/1; 34/14; 36/14 (months)	52; 51; 48%	
Mata, F., et al. (2015)	Community 1. Excess weight; 2. Healthy weight	22; 32 (total 54)	15.14/2.03 15.53/1.70	52.38; 83.33% (38.89%)	40.74%
Obregon, A. M., et al. (2010)	Clinical (OB)	229	9.8/2.1	45.4%	100%
Obregon, A. M.,et al. (2017)	Community	258	11.5/1.6	44%	16.3/44.6
Obregon, A. M., et al. (2017)	Community	258	11.5/1.6	44%	16.3/44.6
dos Passos, D. R., et al. (2015)	Community	335	7.3	51.3%	26/25%
Quah et al. (2017)	Community	636	3.05yr	47.3%	-
Sanchez, U.,et al. (2016).	GOCS-study	1058	8.75yr	51%	27.3/24%
Santos, J. L.,et al. (2011)	1.Community (Normal weight); 2.Community (OW); 3.Community (OB)	124; 44; 126	6-12y	50.3%	16.36/46. 84% 100%

Garcia, K., et al. (2016)	Community (low income)	186	4.34	47.6%	20.9/26.2%
Sleddens, E. F. C., et al (2008)	Community	135	6.5/0.5	49.63%	8.89%
Soussignan, R., et al. (2012)	Community	40	8.5/1.31	45%	50%
Sparks et al. (2012)	Community	229	3.89/0.75	54%	28.8%
Svensson et al. (2011)	Community	174	3.8/1.4	50%	0%
Tong, L., Shi, H., & Li, X. (2017)	Community	785	10.6/1.1	47.9%	19.7/12.9%
van den Berg, L., (2011).	Community	346	9.15/1.79	44.2%	12.17/4.62%
Wang, S., et al. (2017)	Community	151	11.8/1.6	31.8%	100%
Wardle et al. (2001)	1.Community; 2.Community; 3.Community	131; 187; 208	4.2/1.3; 4.2/1.4; 5.6/1.5	47.33; 41.71; 46.63%	-
Webber, L., et al. (2009).	1.Community; 2.Community	239; 167; (total 406)	8.3/0.63;1 1.2/0.55 (9.5/1.6)	49;60. 5% (53.7%)	13/3.3; 18/7.2% (15.3/4.9%)

**Dutch Eating Behavior
Questionnaire for Children
(DEBQ-C)**

Banos et al. (2011)	1.Community (normal weight); 2.Community (OW); 3.Clinical (OW).	280; 31; 81 (Total 473)	11.4/1.2 (Total sample)	49%	0%; 100%; 100%.
Braet et al. (2008)	1.Clinical (OW/OB) and community; 2.Clinical (OW/OB) and community.	1458; 1016	10.1/1.3; 14.9/1.5	58.5%	51/ -%
Braet et al. (2007)	Clinical (OW/OB)	498	10.1 /2.3	63%	100/75.7%
Burt et al. (2014)	Community	56	7.7/1.9	48%	0%
Halberstadt et al. (2016)	Clinical (OB)	120	14.8/2.4	67.5%	-/100%
Ouwens et al. (2012)	Community	962	9.5/1.5	50%	13.5/1.8%
Silva et al. (2013)	Community	453	9.54/1.68	51.7%	25.6/13.2%
van Strien et al. (2008)	1.Community; 2.Community	769; 515	9.6/1.4 9.30/1.44	50%; 51%	18.6/0% (total sample)

Questionnaire of Eating and Weight Patterns Adolescents (QEWPA)

Johnson et al. (1999)	Community	367	13.2/1.89	53%	-
Johnson et al (2001)	Community	106	15.31/1.59	34%	-
Morgan et al. (2002)	Community (OW)	112	6-10y	54%	100%
Perpina et al. (2011)	1.Clinical (OW); 2.Community	71; 128	12.7/2.0	50.2%	1.100% (57.7% Total population)
Steinberg et al. (2004)	Community	263	9.7/1.9	46.4%	54/-%
Tanofsky- Kraff et al. (2003)	Community	88	10/1.8	64.4%	52/-%
Utzinger et al. (2016)	Clinical (Bariatric surgery patients)	242	17.1/1.6	75.6%	100%

Eating Attitudes Test Children (ChEAT)

Anton et al. (2006)	Community	728	9.2/1.5	50%	-
Chen et al. (2009)	Community (low income)	543	10-14y	100%	-

Elliott et al. (2013)	Clinical (OB)	409	12.9/2.4	60%	100%
Gusella et al. (2008)	Community	247	12.6/0.91	57.5%	-
Halvarsson et al. (1998)	Community	117	9-10y	100%	-
Kelly et al. (1999)	1.Community (students grade 2); 2.Community (students grade 4)	111; 117	7.41/0.79; 9.38/0.34	54%; 55%	-
Lynch et al. (2005)	Community	2093	14.09/1.53	51.2%	-
Maloney et al. (1988)	Community	318	9.7/1.24	53.3%	-
Perpina et al. (2011)	1.Clinical (OW); 2.Community	71; 128	12.7/2.0	50.2%	1.100% (57.7% Total sample)
Ranzenhofer et al. (2008)	1.Community (Normal weight); 2.Community (Risk for OW); 3.Community (OW)	152; 45; 220	9.6/3.7; -; 11.6/4.5	49.3%; -; 59.6%	52.7/-%
Smolak et al. (1994)	Community	308	13.2/-	100%	-
Tong et al. (2017)	Community	785	10.6/1.1	47.9%	-

Eating Behaviour and Body Image Test (EBBIT)

Candy et al. (1998)	Community	291	8-13y	100%	-
de Souza Cavalcanti et al. (2016)	Community	1405	10-14y	57%	-
Eating In Absence of Hunger Questionnaire (EAH-C)					
Liang et al. (2016)	Clinical (OW/OB)	117	10.40/1.35	53%	100%
Madowitz et al. (2014)	Clinical (OW/OB)	117	10.42/1.35	53%	100%
Obregon, A. M., Oyarce, K., et al. (2017)	Community	258	11.4/1.6	44.1%	16/44%
Obregon, A. M., Valladares, M et al. (2017)	Community	258	11.4/1.6	44.1%	16/44%
Shapiro et al. (2017)	1.Clinical (exposed to maternal diabetes); 2.control group	50; 217	15.4/0.8; 16.3/1.1	51.1%	-
Silva Garcia et al. (2016)	Community	186	4.34/0.48	47.6%	20.9/26.2%
Tanofsky-Kraff et al. (2008)	Community (Metabolic study)	226	14.4/2.5	54.1%	-/32%

Eating Pattern Inventory for Children (EPI-C)

Hirsch et al. (2014)	Community	521	8.26/0.17	51.1%	19/-%
Ho et al. (2013)	Clinical (OB)	109	13.2/-	58.7%	100%
Munkholm et al. (2016)	Community	1567	11.6/-	52.3%	16.1/-%
Munkholm et al. (2017)	Community	1939	11.5/0.4	52.4%	16.1/-%
Schacht et al. (2006)	Community	373	8-11	55%	15.3/4.6%

Emotional Eating Scale for Children and Adolescents (EES-C)

Bektas et al. (2016)	Community	576	12.83/1.99	45.7%	0%
Limbers et al. (2016)	Community	226	13.19/1.00	61.9%	17.3/14.6%
Perpina et al. (2011)	1.Clinical (OW); 2.Community	71; 128	12.7/2.0	50.2%	1.100% (57.7% Total population)
Tanofsky-Kraff et al. (2007)	Community	159	14.3/2.4	48.7%	37.1/-%

Vannucci, A., et al. (2012)	Community	151	8-18y	-	-
Young et al. (2017)	Community	277	13.26/0.49 4	59.6%	18.1/16.2%
Kids Eating Disorder Survey (KEDS)					
Candy et al. (1998)	Community	291	8-13	100%	-
Childress et al. (1993)	Community	1883	12.0/1.2	49%	-
Childress et al. (1993)	Community	3129	12.0/1.2	51.1%	-
Epstein et al. (2001)	Clinical (OW)	47	10.3/1.1	25/22st	100%
Minnesota Eating Disorder Inventory (M-EDI)/ Minnesota Eating Behavior Survey (MEBS)					
Klump et al. (2000)	1.Community (twins); 2.Community (twins)	680; 602	11.71/0.46 17.46/0.51	100% (Total sample)	-
Klump et al. (2002)	Community (Twins)	512	17.46/0.51	100%	-

Spanos et al. (2010)	Community (Twins)	468	11-17	100%	-
von Ranson et al. (2005)	Community (Twins)	1447	11-17	100%	-
Youth Eating Disorder Examination Questionnaire (YEDE-Q)					
Kass et al. (2017)	Clinical (OW)	241	9.9/1.3	63%	100%
d'Emden et al. (2012)	Clinical (Diabetes)	124	15.41/1.50	53.2%	-
d'Emden et al. (2013)	Clinical (Diabetes)	124	15.4/1.50	53.2%	-
Goldschmidt et al. (2007)	Clinical (OW)	35	13.8/1.6	71.4%	100%
