

An update on prevalence rates of disordered eating behaviours in children and adolescents with overweight or obesity and the management of binge eating disorder

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Abstract

Background: A number of studies have been published in recent years examining disordered eating behaviours (DEBs) in children and young people (CYP).

Objective: To provide an up-to-date review of prevalence rates across a range of DEBs, including food addiction, in CYP living with overweight and obesity, across both community and clinical populations.

Methods: In January 2022, three separate databases were searched (PubMed, MEDLINE and PsycINFO) for papers published after April 2016. The search was updated in February 2024 using identical search terms across MEDLINE, Embase and OVID Journals. Data were extracted by the main author and prevalence rates of DEBs calculated from available data, if not already provided. Included studies were categorised as examining either binge or loss-of-control eating (LOC) only, food addiction and a range of DEBs.

Results: A total of 44 studies were included in this review. Of these, 37 were cross-sectional studies, three were cohort studies, two were prospective observational studies and two were case-control studies. The total number of participants across all included studies was 28,640. In studies focusing on binge or LOC eating alone, prevalence rates and methods of data collection varied widely. Amongst clinical samples, rates of binge eating pre-bariatric surgery were 37.7%, dropping to 18.5% at five years post-surgery. For young people living with obesity and concurrent attention deficit hyperactivity disorder (ADHD) and/or autism spectrum disorder (ASD), 65% reported binge eating symptoms. In community samples, rates of binge/LOC eating ranged from 8.8% to 52.8%. Within studies looking at food addiction in clinical populations, rates ranged from 9.9% to 30.8%; in community samples, this ranged from 16.2% to 23.8%. The Yale Food Addiction Scale (YFAS) and YFAS-Child version were used across all studies collecting data on food addiction, meaning greater consistency and generalisability of results when compared to studies assessing binge/LOC eating or a range of DEBs. Amongst studies assessing a range of DEBs, one found that there was presence of at least one DEB in 82.2% of a clinical population of adolescents living with obesity. Studies looking at a range of DEBs in community samples found prevalence rates ranging from 8.4% to 59.8% using a range of assessment tools.

Discussion: Heterogeneity between studies in terms of assessment tools used, methods of data collection and types of DEBs assessed limits conclusions about the true prevalence of disordered eating among CYP and how many might reach a diagnostic threshold for an eating disorder diagnosis. Further research is needed to help inform service delivery and effective referral and treatment pathways.

1. Introduction

Eating disorders continue to have the highest mortality rate of all psychiatric conditions based on physical consequences of starvation, purging and other eating disorder-related behaviours and suicide, respectively (1). Within child and adolescent populations, overweight is defined as BMI-for-age greater than one standard deviation above the growth reference median and obesity as over two standard deviations above the median (2). Overweight and obesity in children and young people (CYP; defined as age 0–18 years) is one of the most pressing public health issues of the 21st century, with almost 18% of all CYP aged between 5 and 19 years being classified as living with overweight or obesity, equivalent to 340 million CYP worldwide. This number continues to rise (3). Overweight and obesity have serious implications across a variety of biopsychosocial domains. Given that childhood and adolescence are characterised by important physical and psychological developments, living with overweight and obesity during this important period can have far-reaching consequences into adult life (4). There is well-established evidence to show that overweight and obesity in childhood is linked to reduced life expectancy, serious physical health risks in adulthood (including diabetes mellitus and cardiovascular disease) and significant socio-emotional consequences including isolation from peers, reduced self-esteem and poorer academic attainment (5).

Previous research has shown that within populations of adults living with overweight and obesity, rates of disordered eating are higher than in those of healthy weight (6). Less is known about the rates of disordered eating in CYP liv-

ing with overweight and obesity, although there is a growing evidence base on which this review will focus. A 2016 meta-analysis by He et al. (7) found that binge or loss-of-control eating occurred in nearly one-quarter of a sample of 9,818 CYP living with overweight and obesity. They noted the bidirectional influence of obesity and binge eating both being risk factors for one another. Another systematic review and meta-analysis by Yekinejad et al. (8) found that the rate of food addiction was 19% among CYP living with overweight and obesity.

The objective of this review was to provide updated prevalence rates for disordered eating in CYP living with overweight or obesity both in community and clinical samples. To avoid duplication of the meta-analysis by He et al., this systematic review included papers published after April 2016 and expanded the search criteria to include studies that examined a greater range of disordered eating behaviours (DEBs) amongst CYP living with overweight and obesity. There is debate within the field about whether food addiction can be conceptualised as a DEB or as a substance use issue (9). It has been included in this review as part of a broad investigation of disordered eating within a population of CYP living with obesity and because previous research has shown overlap between food addiction, obesity and disordered eating (10).

2. Methods

2.1 Sources and search strategy

The narrative review protocol was registered with PROSPERO. A separate search strategy was developed from the one used by He et al. Three health databases (PubMed, MEDLINE and PsycINFO) were searched on 5th January 2022 using the following search terms: "disordered eating" OR "binge eating" OR "binge eating disorder" OR BED OR binge OR "emotional eating" OR "loss of control eating" OR "food addiction" OR "eating addiction" AND child* OR adolescen* OR "young people" OR boy* OR girl* OR teen* OR youth OR paediatric* AND overweight OR obes* OR "excessive weight" or "raised BMI".

Restrictions placed on the search were as follows: 1. papers published prior to April 2016; 2. papers not published in the English language; 3. papers focusing solely on adult (over the age of 18 years) populations, or where there were a mix of adults and CYP (under the age of 18 years) but data were not separated.

The search was then repeated in February 2024. Due to changes in the available databases, MEDLINE, Embase and OVID Journals were used in the updated search.

The same search terms and restrictions were used for the updated search, apart from the stipulation that only papers published between January 2022 and February 2024 should be included. Duplicates were removed using the search engine followed by the main author (ETB) carrying out title, abstract and then full-paper screening against the inclusion and exclusion criteria according to the PRISMA checklist. See Figure 1 for the PRISMA flowchart.

2.2 Selection criteria

The inclusion criteria were as follows: papers published in English; papers published in a peer-reviewed journal; and papers that reported on rates of DEBs in CYP (under the age of 18 years) living with overweight and obesity or provided enough information for rates to be calculated.

The exclusion criteria were as follows: papers not published in English; papers where rates of DEBs in CYP living with overweight and obesity were not main outcomes; papers that were not original research or reviews (e.g., book chapters/systematic reviews/meta-analyses); papers that were randomised controlled trial protocols or study proposals; and papers focusing only on adult populations.

2.3 Data extraction

Initial title screenings were followed by abstract and then full-paper screenings. Screening was carried out by the main author only. Once papers were identified for inclusion, the data were extracted. This was stored in a spreadsheet that included information on study title, main author, year of publication, country, type of study, number of participants, race, gender, age, BMI/weight status, treatment status, assessment tools, the

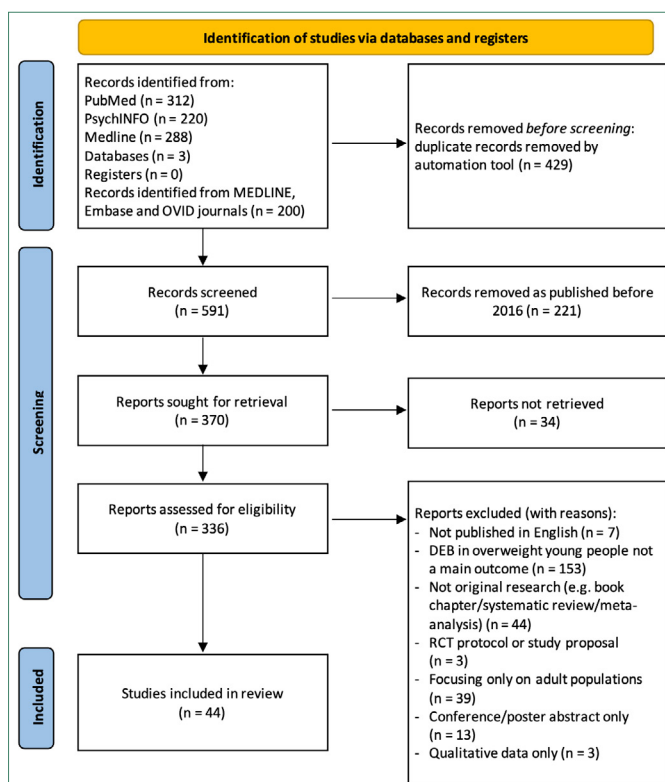


Figure 1. PRISMA flowchart

Abbreviations: DEB = disordered eating behaviour; RCT = randomised controlled trial

DEB assessed and main findings. Prevalence was assessed as the percentage of the studied population who experienced a symptom/disorder according to the assessment tool used.

2.4 Risk of bias and quality assessment

As the majority of included studies were cross-sectional, the Joanna Briggs Institute (JBI) tool for assessing analytical cross-sectional studies was used to assess methodological quality and to determine the extent to which a study had addressed the possibility of bias in its design, conduct and analysis (11). The JBI tool does not specify cut-off scores in terms of categorising studies as being of high, moderate, or low quality; however, for the purpose of this review, studies with scores of six or above were recorded as being of high quality, scores of four and five as moderate quality and below four as being low quality. Details of the different domains assessed with this tool are provided in Appendix 1.

3. Results

3.1 Summary of key features of included studies

Of the 44 included studies 15 were from Europe, 14 from North America, six from the Middle East, three from Asia, two from South America, two from Australia, one from Mexico and one from Africa.

The total numbers of CYP with overweight/obesity across the studies was 28,640.

Sixteen of the studies examined binge or loss-of-control eating (including objective binge episodes, subjective binge episodes and loss-of-control eating without specifying amount of food eaten); eight papers focused on food addiction; 18 looked at a range of DEBs (e.g., bingeing, purging, skipping meals); one study assessed emotional eating; and one included study looked at "secretive eating".

Of the 44 papers, 37 were cross-sectional studies, three were cohort studies, two were prospective observational studies and two were case-control studies. Thirteen were conducted in clinical (treatment-seeking) populations, 29 used community (non-treatment-seeking) samples and two studies looked at participants across clinical and community samples.

Thirty-six studies examined a mix of female and male participants while seven focused on female-only populations and one on a male-only population. The majority of papers examined populations across the weight spectrum and the gender divide specifically within the overweight/obese subset was often not available.

Only 14 studies included ethnicity information as part of the demographic data of their participants. This information was gathered during data extraction but is not included in the results of this review as information was not available for all included studies.

Using the JBI tool, 32 studies were deemed to be of high quality and 12 studies of moderate quality.

A wide range of assessment tools for disordered eating were used across the included papers. Eleven studies used the Eating Disorder Examination Questionnaire (EDE-Q) or its derivatives, seven used the 26-item Eating Attitudes Test or its derivatives, eight used the YFAS, two used the Eating Disorder Inventory or its derivatives, three used the SCOFF questionnaire, two used the Binge Eating Scale (BES) and one each for the following: the Kiddie Schedule for Affective Disorders and Schizophrenia, the Childhood Eating Behaviour Questionnaire, the Diabetes Eating Problem Survey-Revised, the Branched Eating Disorder Test, the Bulimic Investigatory Test Edinburgh (BITE), the Block Food Frequency Questionnaire, the EAT 2010 study survey and the Three-Factor Eating Questionnaire-R21. Eight used non-validated questionnaires/surveys made by researchers. One paper (Wentz et al. (16)) used both the EDI and the EDE-Q; one paper (Caran et al. (46)) used the EAT-26 and the BITE; one paper (Schulte et al. (32)) used the YFAS, the EDE-Q and the Block Food Frequency Questionnaire; and one paper (Järvholm et al. (13)) used the BES and the Three-Factor Eating Questionnaire-R21.

A brief summary of the assessment tools is included in Appendix 2.

Tables 1 to 7 provide summary information including main author, year of publication, assessment methods, JBI scores and the prevalence of DEBs.

3.2 Summary of results

This review highlights the wide range of rates of DEBs across community and clinical populations of overweight and obese CYP.

In studies focusing on binge or LOC eating alone, prevalence rates and methods of data collection varied widely. Amongst clinical samples, rates of binge eating pre-bariatric surgery were 37.7%, dropping to 18.5% at five-year follow-up post-surgery (13), while amongst a sample of CYP living with obesity with concurrent ADHD and/or ASD, 65% reported binge eating symptoms (16). In community samples, rates of binge/LOC eating ranged from 8.8% (25) to 53.8% (recurrent and non-recurrent binge episodes) (21). In one community sample, 4.7% met full diagnostic criteria for BED (24).

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Decker et al. 2022 (12)	USA	Clinical sample, all with severe obesity. Surgical group (those who underwent bariatric surgery) 79.9% female, n = 111; 20.1% male, n = 28. Mean age 16.9 ± 1.4 and non-surgical group (those attending for lifestyle modification programs) 81.9% (n = 68) female; 18.1% (n = 15) male; 16.1 ± 1.4.	Prospective observational study using EDE-Q - Bariatric Surgery version comparing group of CYP who underwent bariatric surgery with a non-surgical group who presented to nonsurgical lifestyle modification programmes. JBI score: 8	Surgical group: objective binge eating, 29.7% (n = 41) vs non-surgical group: 10.8% (n = 9); p = 0.02.
Järholm et al. 2020 (13)	Sweden	Clinical sample: 81 participants post-bariatric surgery and 80 matched controls who underwent conventional treatment. Surgical group: 53 females, 28 males. Control group: 45 females, 35 males. Binge eating prevalence data were only available for surgical group. Surgical group mean age: 16.5 ± 1.2; control group mean age: 15.8 ± 1.2.	Non-randomised matched-control study measuring 5-year mental health and eating pattern outcomes in adolescents with obesity or morbid obesity following bariatric surgery. Disordered eating assessed using the BES and Three-Factor Eating Questionnaire. Other measures taken include the Rosenberg Self-Esteem Scale and the Mood Adjective Checklist. JBI score: 5	Surgical group: binge eating at baseline, 37.6% (n = 29). Binge eating at 5-year follow-up: 18.5% (n = 15).
Spettigue et al. 2020 (14)	Canada	Clinical sample, 182 participants with obesity (98 females, 84 males). Mean age: 15.47.	Cross-sectional study that included adolescents at point of assessment for a paediatric tertiary care weight-management program. Disordered eating was assessed through select questions on binge eating taken from the EDE-Q along with psychiatric and anthropometric data. JBI score: 5	Binge eating present in 49.5%.
Obeid et al. 2020 (15)	Canada	Clinical sample, 212 participants with obesity (109 females; 103 males). Mean age: 15.5 ± 1.22.	Cross-sectional study including obese CYP referred to a tertiary care weight-management program. Disordered eating was assessed using the EDE-Q along with data on depressive symptoms and suicidal ideation using the CDI. JBI score: 5	Binge eating present in 28.4%.
Wentz et al. 2019 (16)	Sweden	Clinical sample, 76 participants with obesity (37 females, 39 males). Mean age: 12.4 ± 3.0.	Cross-sectional study examining disordered eating and neurodevelopment disorders carried out at an obesity treatment centre within a children's hospital. Disordered eating was assessed using the EDI-C and EDE-Q. Participants had either a pre-existing diagnosis of ASD ± ADHD or met criteria for ADHD according to DAWBA. Anthropometric data were gathered. JBI score: 7	65% showed LOC eating; 10.5% met criteria for probable BED or BED-OSFED.
Pearlman et al. 2019 (17)	USA	Clinical sample, 29 participants with overweight and 99 participants with obesity. Mean age: 14.35 ± 1.55.	Cross-sectional study examining family weight-based teasing, psychosocial functioning and eating pathology in military dependent CYP. Sample taken from binge eating disorder and adult obesity prevention trial. Disordered eating was assessed using the EDE-Q. Other measures included the BDI-II. JBI score: 6	47.7% reported LOC eating in last month.
Egbert et al. 2019 (18)	USA	Clinical sample, 385 CYP with overweight or obesity. Mean age: 10.89 ± 2.25.	Cross-sectional study investigating association between LOC eating and ADHD. Sample was selected from 6 different research institutions (enrolled in either non-intervention studies or weight loss programmes). Disordered eating over past 28 days was assessed using EDE along with anthropometric data. Other measure used was CBCL. JBI score: 8	32.5% reported at least one episode of disordered eating (OBE, SBE, OO). 72% of this group reported also experiencing LOC.
Flechtner et al. 2018 (19)	USA	Clinical sample, 817 participants with obesity. Mean age: 9.7 ± 1.9.	Cross-sectional study investigating binge eating symptoms from a baseline survey for participants enrolled in the Study of Technology to Accelerate Research (STAR), a cluster-randomised obesity intervention. Binge eating was assessed with 3 parent-report questions. JBI score: 6	Sneaking, hiding or hoarding food: 33.1%; eating large amounts even when not hungry: 40.3%; inhibited/embarrassed eating in front of others: 8.2%.

Table 1. Binge or loss-of-control eating in clinical samples

Abbreviations: ADHD = attention deficit hyperactivity disorder; ASD = autism spectrum disorder; BDI = Beck's Depression Inventory; BED = Binge eating disorder; BES = Binge Eating Scale; CBCL = Child Behaviour Checklist; CDI = Children's Depression Inventory; CYP = children and young people; DAWBA = Development and Well-being Assessment; DEB = disordered eating behaviour; EDE-Q = Eating Disorder Examination Questionnaire; EDI-C = Eating Disorder Inventory for Children; JBI = Joanna Briggs Institute; LOC = loss-of-control; OBE = objective overeating; OSFED = other specified feeding or eating disorder; SBE = subjective binge eating

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Rozzell-Voss et al. 2024 (20)	USA	Community school-based sample. Of sample with overweight: males, 52.7% (n = 1858); females, 47.3% (n = 1668). Age range: 9–10 years. No mean age provided.	Cross-sectional. Binge eating was assessed using KSADS-5 which relied on parental reports of their child's eating habits over the past 2 weeks. JBI score: 7	12.8% (n = 238) of males reported binge eating; 10.0% (n = 167) of females reported binge eating.
Byrne et al. 2023 (21)	USA	Community sample. All female participants. Mean age: 15.5 ± 1.5. With overweight: 52.9% (n = 18). With obesity: 47.1% (n = 16).	Cross-sectional study. LOC eating was assessed using the EDE-Q. Study used magnetoencephalography (MEG) to investigate attentional bias while evoking neural responses to angry or happy face cues and measured energy intake and macronutrient consumption patterns. JBI score: 8	LOC eating in 46.2% of overweight sample; 53.8% of obese sample.
Pace et al. 2022 (22)	Italy	Community sample. All female participants; n = 56. Mean age: 16.4 ± 1.3.	Cross-sectional study. Binge eating behaviours were assessed using the BES. BES score >17 indicated participants being at risk of BED. The relationship with binge eating behaviours and interview-assessed attachment representations was assessed. JBI score: 6	66.7% (n = 6) of overweight girls scored >17 on the BES.
Sepúlveda et al. 2022 (23)	Spain	Community sample. 37 males with overweight; 47 males with obesity; 42 females with overweight; 40 females with obesity. Age range: 8–12 years (mean age not given).	Cross-sectional study. Questions on LOC eating were derived from definition proposed by Iandolo-Kraft. The relationship between LOC eating and socioeconomic disadvantage, emotional distress, disharmonious family environment and participant's psychological and emotional distress were investigated. JBI score: 7	24.1% overweight participants had LOC eating; 50% of obese participants had LOC eating; difference in LOC eating was significant compared to normal-weight participants (p < 0.001)
Olsen et al. 2021 (24)	Denmark	Community sample. 274 participants with overweight/obesity. Mean age: 16.5 ± 4.2.	16-year follow-up from the Danish Copenhagen Child Cohort (CCC2000). Participants completed a web-based questionnaire adapted from the McKnight Risk Factor Survey and the Avon Longitudinal Study of Parents and Children, including items approximating DSM-V criteria for BED. JBI score: 8	8.5% reported weekly overeating with LOC; 4.7% of the overweight/obese population met diagnostic criteria for BED.
West et al. 2019 (25)	USA	Community sample. 468 participants with overweight/obesity. Mean age: 14.9 ± 1.6.	Cross-sectional study investigating risk factors for binge eating by socioeconomic status. Sample derived from Project EAT (Eating and Activity in Teens and Young Adults), a 15-year longitudinal study of dietary behaviour, weight concerns and psychosocial functioning among a heterogeneous group of young people. Binge eating was investigated using adapted questions taken from the adult version of the Questionnaire on Eating and Weight Patterns-Revised, along with anthropometric and sociodemographic data. JBI score: 8	8.8% of overweight or obese participants reported binge eating (with LOC) in the past year.
Gall et al. 2016 (26)	Australia	Community sample. 59 participants with obesity. Females – non-obese: mean age, 15.49 ± 1.62; obese: mean age, 16.06 ± 1.29; Males – non-obese: mean age, 14.90 ± 1.70; obese: mean age, 15.03 ± 1.39.	Cross-sectional study recruiting CYP across 12 secondary schools. Loss-of-control eating was assessed using a sub scale of the EDE-Q. Other collected data included body dissatisfaction using a subscale of the EDE-Q, physical health status and emotional wellbeing using the K-10. Anthropometric data were also recorded. JBI score: 7	Loss-of-control eating: 48.49% in girls, 14.28% in boys; combined prevalence: 32.2%.
Schlüter et al. 2016 (27)	Germany	Community sample. 163 CYP with overweight/obesity. Mean age: 15.0 ± 2.8.	Cross-sectional study recruiting adolescents from 18 schools. Loss-of-control eating was assessed using a subscale of the EDE-Q. Recurrent LOC was set at >4 episodes of LOC eating in past 28 days and nonrecurrent LOC eating was <4 episodes over last 28 days. The Clinical Impairment Assessment was used to assess severity of psychosocial impairment due to eating pathology. JBI score: 7	Recurrent LOC eating in overweight sample: 21.3%. Recurrent LOC eating in obese sample: 29.3%. Non-recurrent LOC eating in overweight sample: 13.1%. Non-recurrent LOC eating in obese sample: 26.8%. Overall prevalence of LOC eating (both recurrent and nonrecurrent) across overweight and obese sample: 52.8%.

Table 2. Binge or loss-of-control eating in community samples

Abbreviations: BED = Binge eating disorder; BES = Binge Eating Scale; CYP = children and young people; DEB = disordered eating behaviour; EDE-Q = Eating Disorder Examination Questionnaire; EDI-C = Eating Disorder Inventory for Children; JBI = Joanna Briggs Institute; KSADS = Kiddie Schedule for Affective Disorders and Schizophrenia; K-10 = Kessler Psychological Distress Scale; LOC = loss-of-control

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Koca et al. 2023 (28)	Türkiye	Clinical sample, from endocrinology clinic. Female: 48.3% (n = 87); male: 51.7% (n = 93). Mean age: 13.25 ± 2.76. Mean BMI: 31.32 ± 4.62.	Cross-sectional study. Food addiction symptoms assessed using YFAS-C. Internet addiction scores assessed using Parent-Child Internet Addiction Scale. JBI score: 5	Food addiction scores: 27.8 ± 15.6 (p < 0.001) and internet addiction scores: 32.2 ± 20.3 (p = 0.008), both significantly higher in obese group vs healthy group. No significant difference between gender in terms of food addiction score. Individuals with obesity had higher internet addiction scale scores and food addiction scores.
De Almeida et al. 2023 (29)	Brazil	Clinical sample, weight-loss treatment seeking. Female: 53.4% (n = 64); male: 46.7% (n = 56). Mean age: 9.6 years ± 0.7.	Prospective observational study. Food addiction symptoms assessed using YFAS-C over two time points 18 months apart. JBI score: 6	44 occurrences of food addiction – n = 29 in initial assessment, n = 15 in final assessment, n = 4 across both. 33.4% (n = 40) subjects in total exhibited food addiction in at least one assessment.
Cura-Esquivel et al. 2022 (30)	Mexico	Clinical sample attending a paediatric clinic for excess weight and obesity. 163 (56%) boys; 128 (44%) girls. Age range: 6–17 (median age: 15). Mean age not provided.	Cross-sectional study. YFAS-C used to assess symptoms of food addiction. JBI score: 5	Food addiction was present in 14.4% (n = 42) of total population, 13.6% (n = 23) of overweight group and 15.6% (n = 19) of obese group (p = 0.638). Proportion of subjects with FA diagnosis did not differ significantly by age between children and adolescents (p = 0.918) or gender (p = 0.62).
Naghashpour et al. 2018 (31)	Iran	Clinical sample. Sample included 48 participants with overweight, 49 participants with obesity and 20 participants with morbid obesity. Mean age: 9.6 ± 1.7.	Cross-sectional study looking into prevalence of food addiction among a sample of Iranian school students. YFAS-C was used along with collection of other sociodemographic and anthropometric measurements. JBI score: 7	19 of 117 overweight/obese participants reported features meeting diagnostic criteria for food addiction. Prevalence: 16.23%.
Schulte et al. 2018 (32)	USA	Clinical sample. 181 (122 females; 59 males) participants with obesity. Mean age: 13.75 ± 1.35	Secondary data analysis of baseline data taken from a sample of African American CYP enrolled in a 6-month weight loss intervention programme. Disordered eating was assessed using YFAS-C, Youth EDE-Q and Block Food Frequency Questionnaire alongside anthropometric and sociodemographic data. JBI score: 7	9.9% scored above cut-off on the YFAS-C.
Tompkins et al. 2017 (33)	USA	Clinical sample of 26 (14 females; 12 males) participants with obesity. Mean age: 14.0 ± 1.9.	Participants were evaluated before and following a 12-week, evidence-based, outpatient behavioural weight-management program from 2013 to 2015. Food addiction was assessed using the YFAS-C along with measures for health-related quality of life and appetite responsiveness. JBI score: 7	13/26 scored 3 or more on YFAS; 8/26 scored 3 or more and showed clinically significant impairment or distress (5 females and 3 males – this was not statistically significant). Prevalence: 30.8%.

Table 3. Food addiction in clinical samples

Abbreviations: CYP = children and young people; DEB = disordered eating behaviour; EDE-Q = Eating Disorder Examination Questionnaire; JBI = Joanna Briggs Institute; YFAS-C = Yale Food Addiction Scale for Children

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Tosun et al. 2023 (34)	Türkiye	Community sample. Mean age: 15.3 ± 1.6 years. Mix of male and female participants but proportion not specified. 33 participants with overweight; 7 participants with obesity.	Cross-sectional. Symptoms of food addiction were assessed using the YFAS-C. JBI score: 5	3% of overweight participants had food addiction; 14.3% of obese participants had food addiction. No significant difference in YFAS-C scores between males and females or between weight status.
Meseri et al. 2020 (35)	Türkiye	Community sample. 127 male participants with overweight and 60 male participants with obesity; 92 female participants with overweight and 46 female participants with obesity. Mean age not given. Age range: 15–19 years.	Cross-sectional study carried out in 3 high schools in Western Turkey. YFAS was administered through face-to-face interviews along with collection of sociodemographic and anthropometric details. JBI score: 8	Prevalence of food addiction was 25.6% (n = 56) in overweight participants and 29.2% (n = 31) in obese participants. Prevalence: 26.8%.

Table 4. Food addiction in community samples

Abbreviations: DEB = disordered eating behaviour; JBI = Joanna Briggs Institute; YFAS-C = Yale Food Addiction Scale

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Daniel et al. 2023 (36)	Ethiopia	Clinical sample taken from diabetic clinic. Total sample of 91 children and adolescents with overweight. Female: 52.2%; male: 47.8%. Age range: 11–19 years (median age: 15). Mean age not provided.	Cross-sectional study. DEPS-R. Range – purging behaviour (self-induced vomiting, skipping insulin, not taking enough insulin); non-purging behaviour (skipping meals, alternating eating, eating more than usual, avoiding checking blood sugar). JBI score: 6	59.34% (n = 54) of overweight population had DEBs, which was significantly higher than non-overweight group (p < 0.005).
Fogh et al. 2020 (37)	Denmark	Clinical sample. 3621 participants with obesity (1967 female; 1654 male). Mean age: 11.4 ± 4.6.	Cohort study included CYP enrolled into the Danish Childhood Obesity Biobank collecting information about disordered eating using structured interview questions in 3 domains: cognitive restraint, emotional eating and uncontrolled eating, along with anthropometric data. JBI score: 6	DEBs present in 82.2% of the total sample.
Table 5. Range of disordered eating behaviour in clinical samples Abbreviations: CYP = children and young people; DEB = disordered eating behaviour; DEPS-R = Diabetes Eating Problem Survey-Revised				
Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Alshewir et al. 2024 (38)	Saudi Arabia	Community sample, all female participants. Age range: 12–19 years. Mean age: 14.56 ± 1.89. 65.0% (n = 102) with overweight; 35.0% (n = 55) with obesity.	Cross-sectional. DEBs were assessed using the EAT-26. Score of >20 on EAT-26 indicates high risk of eating disorder. JBI score: 6	EAT-26 >20: 28.4% (n = 29; p = 0.433; OR: 1.382; 95% CI, 0.616–3.103) in overweight population; 38.2% (n = 21; p = 0.080; OR: 2.194; 95% CI, 0.911–5.286) in obese population. BMI had a positive correlation with dieting scale (p < 0.001) and negative association with oral control (p < 0.001).
Rossi et al. 2023 (39)	Brazil	Community school-based sample. Female: 52.3% (n = 146); male: 47.7% (n = 133) with overweight/obesity. Age range: 11–14 years. Mean age not provided.	Cross-sectional study. DEBs assessed using a study-specific questionnaire asking about purgative behaviour and binge eating. JBI score: 6	6.3% of overweight/obese sample used laxatives vs 3.2% of normal weight; use of diuretics: 4.2% vs 3.9%; vomiting induction: 7.1% vs 5.6%; overeating: 49.7% vs 43.5%; no eating: 36.2% vs 20.1% – none reached significance.
López-Gil et al. 2023 (40)	Spain	Community school-based sample. 342 children and adolescents with excess weight; female: 56.2%; male: 43.8%. Mean age: 13.9 ± 1.5.	Cross-sectional study. DEBs assessed using SCOFF questionnaire. JBI score: 7	61.4% (n = 135) of overweight population had SCOFF scores ≥2.
Aagaard et al. 2023 (41)	Denmark	Community sample of children and adolescents attending a lifestyle camp in the Netherlands. 174 participants: 60.9% girls and 39.1% boys. Mean age: 11.8 ± 1.38. 16.1% (n = 28) with overweight; 83.1% (n = 146) with obesity.	Cross-sectional study. Emotional overeating was assessed using the CEBQ. Quality of life was assessed using the PedsQL version 4.0. JBI score: 5	74.1% had medium or high tendency to emotionally overeat. QoL was 6.5 points lower (95% CI, 1.3–11.7, p < 0.01) in children with medium emotional overeating score and 13.7 points lower (95% CI, 8.5–18.9, p < 0.01) in children with a high emotional overeating score.
El Shikieri et al. 2022 (42)	Saudi Arabia	Community school-based sample. All female participants. 39 with overweight; 10 with obesity. Mean age: 13.1 ± 2.7.	Cross-sectional study. DEBs assessed using EAT-26 among a population of girls in Saudi Arabia. Information on nutritional status was gathered. JBI score: 5	7.7% (n = 3) of overweight participants had EAT-26 scores > 20; 10.3% (n = 4) of obese participants had EAT-26 scores > 20.
Tsekoura et al. 2021 (43)	Greece	Community sample. 673 participants with overweight; 424 with obesity. Mean age: 12.8 ± 1.4	Cross-sectional epidemiological study carried out in Greek schools using EAT-13. Score of 12 or over indicated high risk for developing an eating disorder. JBI score: 4	EAT-13 score was pathological (>12) in 28.2% (n = 190) of overweight children and 33% (n = 140) of children with obesity. Prevalence: 30%.
Fatima et al. 2020 (44)	Saudi Arabia	Community sample. All female participants. 44 participants with overweight; 18 participants with obesity. Mean age: 17.03 ± 1.25.	Cross-sectional study carried out with female students across 4 high schools in north-west Saudi Arabia. Disordered eating was assessed using the EAT-26 along with sociodemographic and anthropometric data. JBI score: 8	43.2% (n = 19) overweight participants: 50% (n = 9) obese participants scored >20 on EAT-26. Total prevalence of disordered eating in overweight and obese participants: 45.2%.
Hughes et al. 2019 (45)	Australia	Community sample. 640 participants with overweight (324 females; 316 males); 234 participants with obesity (100 females; 134 males). Mean age: 14.4 ± 0.5.	Cross-sectional study using a sample of 14- and 15-year-olds taken from Longitudinal Study of Australian Children (LSAC). DEBs over past 3 months were assessed using the BET along with sociodemographic and anthropometric data. JBI score: 6	Estimated prevalence of regular binge eating in overweight and obese populations was 1.2% and 1.7%, respectively. Estimated prevalence of overvaluation of weight for sense of self in overweight and obese populations was 21.3% and 22.4%, respectively. Estimated prevalence of regular engagement in compensatory behaviours in overweight and obese populations was 7.0% and 4.4%, respectively.
Caran et al. 2018 (46)	Brazil	Community sample of 98 participants (36 males; 62 females) with overweight/obesity. Mean age: 16.9 ± 0.6.	Cross-sectional school-based study investigating associations between DEBs and energy and nutrient intake. EAT-26 and BITE were used to assess disordered eating symptoms with scores of 20 or over and 10 or over indicating abnormal/unusual food patterns, respectively. Anthropometric data were also collected. JBI score: 5	Across overweight/obese females, 15.6% had EAT-26 score > 20; 51.4% had BITE score > 10. Across overweight/obese males, EAT-26 score was not shown; 11.7% had BITE score > 10.

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Sepúlveda et al. 2018 (47)	Spain	Community sample of 170 (86 males; 84 females) participants with overweight/obesity. Mean age: 10.03 ± 1.55.	Cross-sectional study investigating loss-of-control eating and childhood mental disorders in youth with overweight/obesity. DEBs were assessed using the CHEAT. Other mental disorders were assessed using K-SADS-PL, STAI-C and CDI. Anthropometric data was also collected. JBI score: 7	15.6% had scores of ≥20 on CHEAT.
Almuhlaft et al. 2018 (48)	Saudi Arabia	Community sample of 65 female participants with overweight/obesity. Mean age: 16.8 ± 0.9.	Cross-sectional study examining early menarche, obesity and DEBs (binge eating, self-induced vomiting and use of laxatives). EAT-26 was used to assess DEBs. Anthropometric data were collected. JBI score: 8	19.4% of overweight/obese population showed DEBs.
Kim et al. 2018 (49)	South Korea	Community sample of 6953 participants with overweight and 3307 participants with obesity (total: 10,260). Mean age not provided.	Large cross-sectional study with participants taken from the 11th Korea Youth Risk Behavior Web-based Survey (KYRBS) giving a nationally representative sample of adolescents. DEBs over the past 30 days was assessed using the following questions: (a) "fasting (skipping meals for >24 hrs)"; (b) "eating only one type of food, such as grapes, eggs, or milk" (referred to as the one-food diet); (c) "vomiting"; (d) "using laxatives or diuretics"; and (e) "taking diet pills without a doctor's prescription". Anthropometric and sociodemographic data were obtained from self-reported measures. JBI score: 4	DWCB in obese sample: 11.6%; DWCB on overweight sample: 9.7%.
Bauer et al. 2017 (50)	USA	Community sample. 11 62 participants with overweight, obesity or severe obesity. Mean age: 14.3 ± 1.9.	Cross-sectional study with participants taken from EAT 2010 study which recruited across 20 schools. EAT 2010 survey was used to investigate "extreme weight control behaviours" (use of diet pills, self-induced vomiting, use of laxatives or diuretics) and binge eating along with sociodemographic and anthropometric measurements. JBI score: 7	Extreme weight-control behaviours in overweight group: 8.4%; obese group: 13.5%; severely obese group: 13.2%. Binge eating in overweight group: 7.9%; obese group: 9.9%; severely obese group: 17.1%.
Rodgers et al. 2017 (51)	USA	Community sample. 886 participants with overweight/obese. Mean age: 14.6 ± 2.0.	Cross-sectional study with participants taken from the EAT 2010 study (as per Bauer et al. (50)). Disordered eating was assessed using study-specific questions which had been deemed to have adequate concurrent validity and test-retest reliability. Sociodemographic and anthropometric data were also gathered. JBI score: 6	Dieting: 59.3%; unhealthy weight-control behaviours: 59.8%; overeating: 18.2%.
Feng et al. 2017 (52)	China	Community sample. 77 participants with overweight/obesity. Mean age: 15.1 ± 1.7.	Cross-sectional study which recruited participants from a middle school. DEBs were assessed using the SCOFF questionnaire. Anthropometric data were taken from self-reports of height and weight. Body Part Dissatisfaction Scale, Positive and Negative Affect Schedule, Perceived Sociocultural Pressure Scale, media use and sociodemographic data were also collected. JBI score: 5	Prevalence of DEB: 42.9%.
Nurkkala et al. 2016 (53)	Finland	Community sample. 373 male-only participants with overweight/obesity. Mean age: 17.9 ± 0.7.	Cross-sectional study using participants from the MOPO study which recruited from all conscription-aged men at mandatory military call-ups. Disordered eating was assessed using 2 subscales from EDI-3 (drive for thinness and bulimic behaviour). Other gathered information included physical activity, sociodemographic and anthropometric data. JBI score: 8	Drive for thinness: 11.8%; bulimic behaviour: 3.2%; DEB overall: 12.6%.

Table 6. Range of disordered eating behaviour in community samples

Abbreviations: BET = Branched Eating Disorder Test; BITE = Bulimic Investigatory Test Edinburgh; BMI = body mass index; CDI = Children's Depression Inventory; CEBO = Child Eating Behaviour Questionnaire; CHEAT = Children's Eating Attitudes Test; CI = confidence interval; CYP = children and young people; DEB = disordered eating behaviour; DEPS-R = Diabetes Eating Problem Survey-Revised; DWCB = disordered weight-control behaviours; EAT-26 = Eating Attitudes Test; K-SADS-PL = Kiddie Schedule for Affective Disorders and Schizophrenia Present and Lifetime Version; PedsQL = Paediatric Quality of Life Inventory Questionnaire; STAIC = State-Trait Anxiety Inventory for Children

Study author and year	Country	Sample	Assessment method and JBI score	Prevalence of DEB
Al Mutsaka et al. 2023 (54)	UAE	Mixed school and clinical sample. Obese sample: female: 46% (n = 121); male: 54%; (n = 142). Age range: 5–16 years. Mean age not provided.	Case-control. DEBs assessed using SCOFF questionnaire. JBI score: 6	42% (110) of obese participants had positive SCOFF results (score ≥ 2) vs 7% of normal-weight participants.
Kass et al. 2017 (55)	USA	Mixed community and clinical sample. 577 participants with overweight or obesity. Mean age: 11.18 $\pm$ 2.45.	Cross-sectional study with participants taken from those presenting for research studies or presenting for treatment at 5 separate eating disorder or obesity treatment centres. Data was collected using EDE-Q or CHED. Other information on behaviour and mood was gathered using the CBCL and CDI along with sociodemographic and anthropometric data. JBI score: 6	Secretive eating: 19.2%. Loss-of-control episodes: 30.7%. Purging episodes: 2.8%.

Table 7. Range of disordered eating behaviours in mixed community and clinical samples
Abbreviations: CBCL = Child's Behaviour Checklist; CDI = Children's Depression Inventory; CHED = Child Eating Disorder Examination Questionnaire; DEB = disordered eating behaviour; EDE-Q = Eating Disorder Examination Questionnaire; JBI = Joanna Briggs Institute

Within studies looking at food addiction in clinical populations, rates ranged from 9.9% (32) to 33.4% (29). In community samples, this ranged from 3% (34) to 26.8% (35). Tompkins et al. (33) found that 30.8% of young people living with overweight or obesity within their clinical sample met "diagnostic criteria" for food addiction. Amongst these, there were statistically significant lower rates of attendance and higher rates of attrition from the weight-loss intervention programme, along with significantly lower psychosocial health-related quality of life scores. Data on food addiction were gathered using the YFAS across all studies, meaning greater consistency and generalisability of results.

Amongst studies assessing a range of DEBs, Fogh et al. (37) found at least one disordered eating behaviour in 82.2% of a clinical population of CYP living with obesity enrolled in a multidisciplinary obesity treatment programme. The remainder of studies looking at a range of DEBs were community samples which found prevalence rates ranging from 8.4% (50) to 61.4% (40), again with a wide range of assessment methods and ways of defining DEBs. López-Gil et al. (40) used a score of 2 or more on the SCOFF questionnaire to define the presence of DEBs. The SCOFF questionnaire was designed to detect anorexia nervosa and bulimia nervosa in adults and may have limited utility in overweight and obese CYP populations (56). Rodgers et al. (51) found presence of DEBs in 59.8% of participants using study-specific questions that categorised a broad range of DEBs, including smoking as a way to control weight and ever having changed the way the participant ate in order to lose weight.

Many of the papers showed increased rates of comorbid psychiatric disorders. Spetigue et al. (14) found that 37% of a population of CYP living with obesity reported symptoms of social anxiety, which was higher amongst CYP with obesity who engaged in binge eating when compared to CYP with obesity who did not binge eat. Another paper looked at associations between binge eating and ADHD and found that nearly three-quarters of a group with both overweight/obesity and ADHD experienced LOC eating (18). Negative affect was found to be significantly associated with DEBs (52).

Quality of life was also shown to be affected, with one study reporting that CYP with a high tendency to emotional overeating had significantly lower quality-of-life scores compared to those with a low tendency to emotional overeating (41).

Family and peer interactions were shown to be negatively impacted, with Pearlman et al. (17) finding that the presence of family weight-based teasing was significantly associated with greater eating concern, shape concern, weight concern and global eating pathology when using the EDE. Amuhlaft et al. (48) found that a group of obese CYP had significantly lower scores of self-perception of body image and higher scores of perceived peer pressure compared to non-obese participants. Attachment relationships were implicated in DEBs, with Pace et al. (22) highlighting that insecure attachment to caregivers acts as a risk factor for binge eating, through affecting emotional regulation leading to "emotional eating".

The study by Egbert et al. (18), which was the only study investigating the relationship across differing socioeconomic statuses and DEBs, found that belonging to a lower socioeconomic group was associated with binge eating.

4. Discussion

This review summarises the high rates of DEBs in CYP living with overweight and obesity across both clinical and community settings globally, and the far-ranging impacts that these behaviours can have on quality of life and wider mental health outcomes. Similar to findings from He et al. in their 2016 meta-analysis (7) looking into binge/LOC eating only, rates of DEBs varied widely between different studies and showed a high degree of heterogeneity. This review included studies assessing a broader range of DEBs. Heterogeneity of assessment methods and prevalence rates remained a feature of studies published after 2016. Future research into this area may benefit from the use of a standardised tool, such as the EDE-Q, to allow for more meaningful comparisons and generalisability of results. While not all CYP with disordered eating will go on to develop eating disorders, research has shown that DEBs predict future outcomes related to obesity and eating disorders (57).

CYP eating disorder services in the United Kingdom continue to see an increase in referrals since COVID-19 (58). This is reflected through NHS England's access and waiting time initiative which stipulates that "urgent" cases should be seen within one week of referral. In 2017/18, 78.9% of these cases were seen within this timeframe compared with just 59% of cases in 2021/22 (59), highlighting the increased pressure on services. Rates of obesity have also increased during the pandemic, likely due to changes in dietary patterns and reduced physical activity (60). Recognising that obesity itself is a risk factor for disordered eating, it can be postulated that rates of DEBs associated with overweight and obesity have also increased. Greater demand on eating disorders services and Complications from Excess Weight (CEW) clinics (61) has resulted in longer waiting times for assessment and treatment and may be acting as a barrier to CYP living with overweight and obesity accessing services appropriately and in a timely manner. Given that disordered eating behaviours and body dissatisfaction may reflect an eating disorder prodrome (62), identifying and targeting DEBs in CYP living with overweight and obesity with prevention and early intervention strategies could help to treat symptoms before they develop into eating disorders and improve health trajectories over the life course.

Development and targeting of prevention and early intervention strategies for DEBs in the context of overweight and obesity need to additionally consider potential weight stigma, including self-stigma, and how this might impact on help-seeking behaviours (63). Research shows that individuals at higher weight may delay or avoid accessing treatment due to self-stigma or past negative interactions with healthcare professionals (64). Once they have accessed treatment, weight stigma can be exhibited by clinicians working in eating disorder services, with some feeling uncomfortable treating patients with obesity (65). Patients presenting with symptoms meeting the diagnostic threshold for binge eating disorder (BED) are more likely to be overweight or obese (66) and therefore potentially more likely to be subject to weight stigma. Since BED was included as a standalone diagnosis within DSM-5, it has become an increased focus for research (please see Appendix 3 for DSM-5 diagnostic criteria for BED). A recent meta-analysis assessing the prevalence of BED in CYP showed that it occurs at similar rates to anorexia nervosa and bulimia nervosa (67); however, there are still discrepancies between available resources for these disorders despite the high burden on those suffering from BED (68). This is highlighted to an extent within current UK guidance for treatment of eating disorders with first-line treatment of anorexia nervosa and bulimia nervosa taking the form of 18 to 20 one-hour sessions of family therapy over the course of one year and six months, respectively (see other articles in this issue for more detail on treatment modalities for other eating disorders). In comparison, first-line treatment for BED recommends guided self-help which should take place over 16 weeks and include the following components: cognitive behavioural self-help materials, a focus on adherence to the self-help programme and four to nine brief supportive sessions with a clinician each lasting around 20 minutes to supplement the self-help programme. If it is not possible to deliver guided self-help or it has been ineffective after four weeks of treatment, then cognitive behavioural therapy for BED should be offered as second-line treatment (69). Some studies have reported the use of dialectical behaviour therapy (DBT) in effectively treating BED however, due to small sample sizes, larger randomised controlled trials are needed to further assess DBT as a treatment for BED in young people (70).

The lack of larger studies into effective treatments for BED may reflect its more recent addition into diagnostic classifications compared to anorexia nervosa and bulimia nervosa. Health outcomes in CYP with BED are likely to be improved with more research focused on treatment approaches and outcomes. Based on studies investigating weight stigma in adults, and weight stigma being recognised as also impacting young people (65), there appears to be a need for further research into how CYP living with overweight and obesity experience both preventative strategies targeting DEBs, how they experience treatment within specialist eating disorders services and how this may impact on outcomes.

Food addiction is not currently listed as a diagnosis within DSM-5; however, given the prevalence of high symptom scores according to YFAS within CYP with overweight or obesity highlighted by this review, this appears to be another area that would benefit from increased research. There should be careful consideration of the impact of including food addiction in discussions on the subject of DEBs and eating disorders. This is due to the conceptualisation and management of addictive behaviours differing widely from DEBs and eating disorders.

5. Strengths and limitations

Strengths of this review include the assessment of prevalence of a wide range of DEBs, including food addiction, across a large total sample of CYP in a range of settings.

The conclusions that can be drawn from this review in terms of binge and LOC eating and ranges of DEBs are limited by the degree of heterogeneity amongst studies in terms of methods of data collection and reporting. To be able to draw firmer conclusions about prevalence rates, the data would benefit from separate meta-analyses across the different domains assessed (i.e., binge eating/LOC eating and food addiction). Data on rates of food addiction appear to be more robust due to the use of a single measure. However, the concept of food addiction itself does not have universal consensus (71). Additional limitations for this study were the lack of a second reviewer of included papers and the lack of co-production in the generation of the review, which could have consulted those with lived experience of the subject matter.

6. Conclusions and implications

With high rates of CYP with overweight and obesity reporting DEBs, it is imperative that individuals can access appropriate care at an early stage to prevent poor health outcomes in the immediate-to-longer term. This involves routinely assessing DEBs in CYP with higher weight to ensure opportunities for early intervention are not missed.

More research is needed to investigate novel strategies for reducing DEBs within CYP living with overweight or obesity that take a holistic biopsychosocial approach, given the complex aetiology and comorbidity of these behaviours. More longitudinal studies in this area could improve understanding of how DEBs evolve and intersect with weight trajectories in CYP. Further research into this area could be used to help inform development and delivery of public health and primary preventative strategies aimed at reducing DEBs in CYP living with overweight and obesity, along with informing integrated care pathways that address both DEBs and overweight/obesity simultaneously. An additional focus of research could be to assess the effectiveness of current available treatments for BED in this age group.

Appendix 1

1. JBI checklist for assessing cross-sectional analytical studies uses the following eight domains.
2. Were the criteria for inclusion in the sample clearly defined?
3. Were the study subjects and the setting described in detail?
4. Was the exposure measured in a valid and reliable way?
5. Were objective, standard criteria used for measurement of the condition?
6. Were confounding factors identified?
7. Were strategies to deal with confounding factors stated?
8. Were the outcomes measured in a valid and reliable way?
9. Was appropriate statistical analysis used?

Appendix 2

Description of assessment tools used.

Eating Disorders Examination Questionnaire (EDE-Q): Self-report questionnaire which consists of 36 items and generates four subscales, "dietary restraint", "eating concern", "shape concern" and "weight concern". Items measuring binge eating, self-induced vomiting and loss-of-control eating are also incorporated in the scale, but not included in the total score.

Eating Attitudes Test (EAT)-26: Standardised self-report measure of symptoms and concerns characteristic of eating disorders. Score of >20 indicates high risk of an eating disorder.

Yale Food Addiction Score (YFAS): A 25-item self-report measure that has been developed to identify those who are most likely to be exhibiting markers of substance dependence with the consumption of high-fat/high-sugar foods. A food addiction symptom (e.g., tolerance, withdrawal, loss of control) count can be obtained, which is similar to the criteria for substance dependence of the DSM-IV-TR (72). Additionally, two items assess clinically significant impairment or distress from eating. Food addiction can be "diagnosed" when three symptoms and clinically significant impairment or distress are present.

Eating Disorder Inventory (EDI): Self-report questionnaire dealing with symptoms of eating disorders and related behaviour. The instrument consists of 91 items subdivided into 11 subscales. The first three subscales, "drive for thinness" (excessive concern with dieting), "bulimia" (uncontrolled overeating) and "body dissatisfaction" (discontent with body shape), are categorised as symptom subscales. The remaining eight are classified as psychological subscales and include "ineffectiveness" (worthlessness and lack of control over one's life), "perfectionism", "interpersonal distrust" (reluctance to have close relationships), "interoceptive awareness" (uncertainty in respect of emotional states related to hunger and satiety), "maturity fears", "asceticism" (seeking virtue in self-discipline), "impulsive regulation" and "social relationships" (insecurity in terms of social interplay). A total score can be calculated based on the sums of the 11 subscales.

SCOFF Questionnaire: Screening instrument for detecting eating disorders based on the following questions: "Do you make yourself sick because you feel uncomfortably full?"; "Do you worry you have lost control over how much you eat?"; "Have you recently lost more than one stone in a 3 month period?"; "Do you believe yourself to be fat when others say you are too thin?"; and "Would you say that food dominates your life?". One point is given for every "yes"; a score of ≥ 2 indicates a likely case of anorexia nervosa or bulimia nervosa.

Binge Eating Scale (BES): A questionnaire consisting of 16 items for assessing behaviours such as loss-of-control overeating and eating unusually large amounts of food. Total scores range from 0 (less binge eating) to 46 (more binge eating). The BES is a good indicator of binge eating in patients undergoing metabolic and bariatric surgery, and a BES score of 17 or lower is suggested as a cut-off for distinguishing patients with no binge eating from patients with binge eating (those with scores > 17).

Branched Eating Disorder Test (BET): Validated tool to assesses eating disorder symptoms over the past three months. The BET consists of nine stem items branching out to a maximum of 31 items. The items map closely onto symptoms of anorexia nervosa and bulimia nervosa as defined in the DSM. Minor revisions were made to the original BET (which had consisted of 10 stem items and a maximum of 27 items) to ensure consistency with the current DSM-5 anorexia nervosa and bulimia nervosa criteria and to clarify wording.

Bulimic Investigatory Test Edinburgh (BITE): A 33-item self-rating scale that consists of two subscales: the symptom scale (30 items), which measures the degree of symptoms, and the severity scale (3 items). Total score is the sum of the two subscale scores. A total score of > 25 indicates a possible case of binge eating.

Block Food Frequency Questionnaire: A 60-item questionnaire designed to measure an individual's relative nutrient intake as well as absolute nutrient values, to assess both nutrients and foods, and to assess diets of a variety of demographic groups

EAT 2010 Survey: A 96-item self-report about eating, physical activity and weight-related behaviours designed to be used as part of a research project with middle school and high school students.

The Three-Factor Eating Questionnaire-R21 (TFEQ-R21): A 21-item questionnaire that assesses three aspects of eating behaviour: emotional eating (eating as a response to negative emotions), uncontrolled eating (eating in response to food exposure or hunger) and cognitive restraint (trying consciously to restrict eating). Scale scores range from 0 to 100. A higher score indicates more of the respective eating behaviour. The TFEQ-R21 has been validated in adolescents.

Appendix 3

DSM-5 diagnostic criteria for binge eating disorder (73).

1. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following.
 - A. 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.
 - B. The sense of lack of control overeating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating).
2. Binge eating episodes are associated with three (or more) of the following.
 - A. Eating much more rapidly than normal.
 - B. Eating until feeling uncomfortably full.
 - C. Eating large amounts of food when not feeling physically hungry.
 - D. Eating alone because of being embarrassed by how much one is eating.
 - E. Feeling disgusted with oneself, depressed, or very guilty after overeating.
3. Marked distress regarding binge eating is present.
4. The binge eating occurs, on average, at least 1 day a week for 3 months
5. 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:

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

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