

REVIEW

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Interventions for improving psychological symptoms in binge eating disorder (BED) and loss of control (LOC) eating in childhood and adolescence: a systematic scoping review

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Abstract

Background Despite reports of high incidence and prevalence, relatively few studies have investigated outcomes for children and adolescents with binge eating disorder (BED) and loss of control (LOC) eating. This study aimed to scope the available literature systematically.

Methods A systematic scoping review methodology was implemented. Five databases (Medline, PsycInfo, Embase, CENTRAL and Scopus) were searched on the 23rd of August 2024 for relevant peer-reviewed journal articles and dissertations. No beginning time point was specified, and the end time point was chosen as the 23rd of August 2024. Restrictions were placed on age (under 20), diagnosis (BED, LOC eating) and study design (quantitative).

Results Ten quantitative studies were identified: eight randomised controlled trials and two case series. Outcome data for 2400 young people were synthesised. Most studies (70%) had a sample size of fewer than 100 participants. Treatment modalities were heterogeneous and included psychological therapies such as cognitive behavioural therapy (CBT), dialectical behavioural therapy (DBT), interpersonal therapy (IPT) and group schema therapy. One study examined the role of medication. The results suggested that six different treatment modalities (CBT (group and individual), IPT, DBT, family-based IPT (FB-IPT), and medication) were associated with a reduction in the number of binge eating episodes and LOC eating. In terms of other psychological aspects such as depression, anxiety and self-esteem, the data were sparse, and it was difficult to draw meaningful conclusions.

Conclusions The findings highlight a paucity of evidence-based interventions in this area for young people with BED and LOC eating. This is an emerging and important field in child and adolescent eating disorders as it is now ten years since BED was introduced into the DSM-V with prevalence estimates higher than other eating disorders in this population. As the onset of binge eating often occurs in late childhood or adolescence there is a role for early intervention. Further research into the efficacy of different therapeutic options for this age group is needed.

Plain English Summary In this review, the authors searched for studies where treatment for binge eating disorder (BED) or loss of control eating (LOC) in young people (under 20 years old) had been trialled. They wanted to see which treatments could improve the mental health of young people with these conditions. To ensure that as many studies as possible were included, five different databases were searched. Ten studies were found and the majority of these were small studies with less than 100 participants. Nine of the studies investigated the role of talking therapies,

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for example, cognitive behavioural therapy and one study examined how medication helped. The talking therapies used in each of the nine studies were varied. The authors found that, on the whole, talking therapy and medication helped with the number of binge eating episodes and LOC eating but it was less easy to understand if they helped with depression and anxiety which are both commonly associated with BED and LOC eating. The results of this review show that more research is needed into this area as few studies were found and BED and LOC eating are becoming more frequently diagnosed in young people.

Keywords Binge eating disorder, Loss of control eating, Adolescence, Childhood, Interventions, CBT, DBT, IPT

Background

Evidence suggests that binge eating disorder (BED) is the most common eating disorder amongst adolescents [1] with recent estimates suggesting a prevalence of 1–4% [2, 3]. It appears to be more gender-balanced with one study finding adult women were at increased odds of 2–3 times that of men in terms of being affected by the disorder [4]. This is in contrast to anorexia nervosa (AN) and bulimia nervosa (BN) where the female-to-male ratio is closer to 10:1 [5, 6]. BED has also been reported to occur more among diverse ethnic and racial backgrounds [7].

BED and binge eating are associated with both impaired physical and mental health, with increased rates of obesity [8] and co-morbid anxiety and depression [7, 9]. The psychological impact of BED is present regardless of body mass index (BMI) or body weight which highlights the importance of the distress associated with binge eating, in the clinical impairment of this disorder [10]. BED is also often recurrent, with two peaks of onset, immediately after puberty (mean age of 14 years) and late adolescence (between 18–20 years) [2]. It is therefore important to consider the role of early intervention [11, 12].

BED has been included as its own diagnostic entity in the Diagnostic Statistical Manual of Mental Disorders (DSM) since the 5th edition [13]. The aetiology of BED is hypothesised to be complex involving multiple biopsychosocial influences [14]. However, one key theory for the maintenance of the disorder is the affect regulation model where binge eating episodes are triggered by, and act as a temporary relief from, negative affect [15]. Emotional regulation difficulties are likely key in this population and it has also been noted that interpersonal difficulties have been reported more frequently in young people with BED [16]. It has also been hypothesised that BED results from certain neurocognitive profiles such as difficulties in inhibitory control and altered reward processing [17]. Linked to this is a ‘food addiction’ hypothesis, due to neurocognitive similarities between BED and addictive substance use [7]. This is a contentious area which requires further study [18].

Treatment is most often based in psychological work. International intervention guidelines are largely lacking

for the treatment of child and adolescent BED. UK NICE (2017) guidance suggests using the adult recommendations, for which guided self-help Cognitive Behavioural Therapy (CBT) is the first line recommended treatment and the most frequently used psychological approach in adults with BED [7]. Other commonly used treatment modalities with adults include Interpersonal Psychotherapy (IPT) and Dialectical Behavioural Therapy (DBT) [19]. The rationale for these interventions is based on the proposed maintenance theories of binge eating around negative affect, interpersonal difficulties (noted to be more common in people with BED and noted to be related to LOC eating [20]) and emotional dysregulation. IPT aims to enhance the quality of relationships, which in turn can improve mood, meaning that individuals are less likely to use food as a coping mechanism. DBT has been shown to be helpful in adolescents struggling with emotional dysregulation [21]. Medication (serotonin reuptake inhibitors [SSRI] or stimulants) have also been trialled as a treatment option [7] with lisdexamfetamine being the only licensed medication for BED in adults in the United States of America (USA) [22].

This systematic scoping review aims to synthesise the current evidence for interventions that target the psychological symptoms of BED and LOC eating in children and adolescents. A review exploring this has recently been published, however, it only included the adult population [7]. This review’s importance stems from the prevalence of BED in childhood and adolescence along with the impact on both physical and mental health as well as the potential for early intervention. LOC eating was included in this scoping review due to the limited available data for BED and because it is a core component of the presentation of BED [23]. LOC eating is characterized by a subjective lack of control over eating, regardless of the amount of food reportedly consumed [24]. LOC eating is the BED criterion most associated with negative psychological symptoms, for example, depression and anxiety [25]. Furthermore, research has found LOC eating behaviours during adolescence increase the risk of developing eating disorders in later life [26].

This review focused on psychological symptoms, rather than BMI or weight loss. Weight is not part of

Table 1 Eligibility Criteria

	Included	Excluded
Publication type	<ul style="list-style-type: none"> - Peer-reviewed articles - Dissertations 	<ul style="list-style-type: none"> - Conference abstracts - Books and book chapters - Non-peer-reviewed articles - Study protocols, - Editorials
Language	<ul style="list-style-type: none"> - English 	<ul style="list-style-type: none"> - non-English language
Study objectives	<ul style="list-style-type: none"> - Any study that reports on outcomes of an intervention to address binge eating disorder, subthreshold binge eating disorder or LOC eating 	<ul style="list-style-type: none"> - Descriptive only
Methodology / design	<ul style="list-style-type: none"> - Quantitative - Any treatment setting 	<ul style="list-style-type: none"> - Qualitative studies - Review articles - Meta-analyses - Satisfaction, feedback or acceptability data only (no qualitative data analysis methodology described) - Case study design - Descriptive quantitative data only (no statistical analyses conducted) - Data collection methodology not described
Sample	<ul style="list-style-type: none"> - Child and Adolescent (up to age 20)* - People with a diagnosis of BED, subthreshold BED or LOC eating 	<ul style="list-style-type: none"> - Clinician only data - Caregiver only data - Mixed BED and other eating disorder samples in which the BED sub-group is not reported separately

* If a study included people aged under 20 within a mostly adult sample (for example, aged 16–25) the study was not included as this was assessed as being an adult intervention

the diagnostic criteria for BED and the psychological impact of BED is present regardless of BMI or body weight [27]. This also fits with an increased drive in recent years to reduce the focus on weight loss and focus more on improvement in psychological well-being, as encapsulated in the 'Health at Every Size' (HAES) framework [28]. The HAES philosophy promotes the concept that an appropriate weight for an individual cannot be determined by calculating BMI or body fat percentages and that it instead should be defined by the weight a person settles at when they eat listening to internal signals of hunger/satiety and participate in regular and appropriate physical exercise [29]. This review focused on studies that examined BED or LOC eating only rather than those that merged results with treatment for BN. This was because although there is some overlap between these conditions, it was deemed important to delineate the treatment, as BED is a distinct and increasingly prevalent eating disorder amongst the adolescent population.

Method

Existing research into interventions that improve psychological symptoms for BED was explored using a systematic scoping review methodology [30]. This

methodology was deemed to be most appropriate given the relative lack of studies in this area. To conduct this review, current systematic scoping review guidelines were used [30] along with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) extension for scoping reviews [31]. The search criteria were developed by one author (PLB) who synthesized the research question using the PCC (population, concept, context) framework [32] (see supplementary information, appendix 1). PLB executed the initial search strategy (see supplementary information, appendix 2), selection of studies and data extraction. This was reviewed by JB in an iterative process and a consensus reached. As per guidelines regarding scoping review methodology, a review protocol was not registered on PROSPERO [33].

Eligibility criteria

Eligibility criteria for the review are presented in Table 1.

Search strategy

Five databases (PsycInfo, Medline, Embase, CENTRAL and Scopus) were searched. Searches using variations of the terms 'binge eating disorder' / 'subthreshold binge eating disorder', 'adolescents' and 'intervention' were

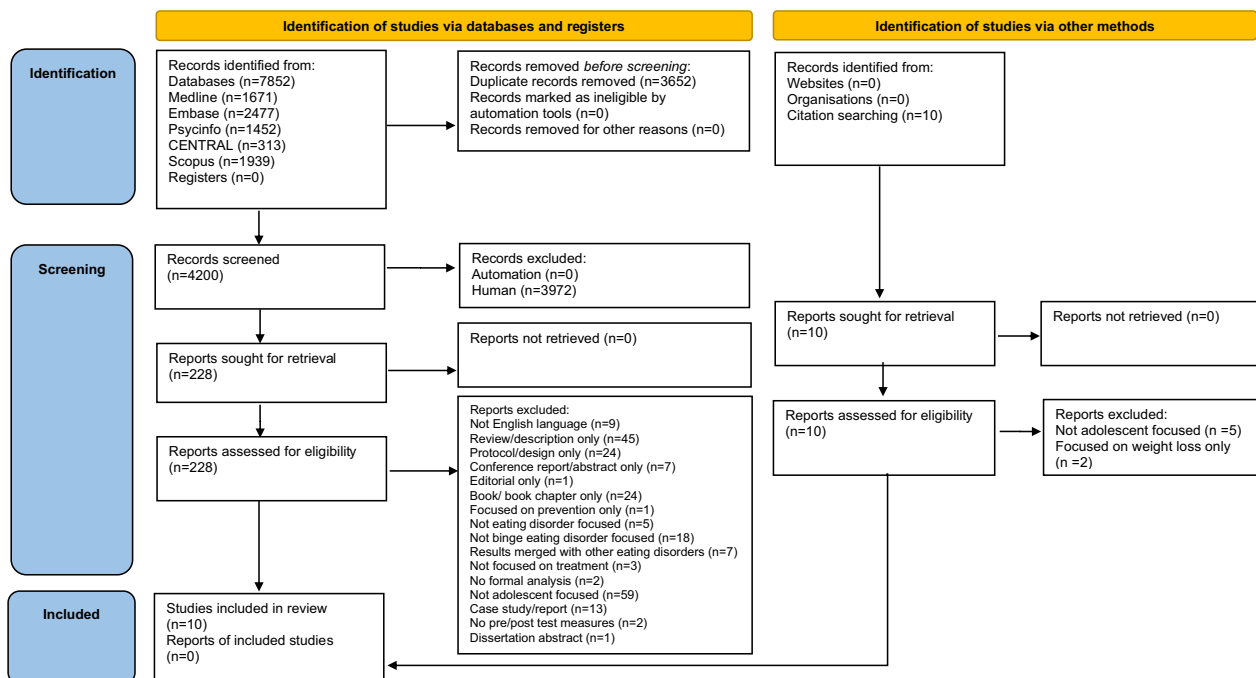


Fig. 1 PRISMA flow diagram [34]

carried out on 23rd August 2024 (see supplementary material, appendix 1 for exact search terms used). A broad search strategy was created to capture as many studies as possible.

Selection process

After the initial search was completed, the references were downloaded into Zotero software, which was then used throughout the screening process. Duplicates were identified and removed. Titles and abstracts were scanned, and papers initially included/excluded based on title and abstract. For those papers included after this initial screen, full-text articles were retrieved online, and studies were then screened again and included/excluded according to the eligibility criteria. Citation searching was then carried out to screen for further papers that may be eligible to be included. See Fig. 1 for the PRISMA flowchart.

Data extraction and analysis

All studies included were quantitative and categorised according to three possible study types: randomised control trials (RCTs), non-randomised comparison studies and case series. Baseline data were extracted from each study (age, gender, ethnicity) as well as intervention characteristics (setting, modality, number of sessions, duration of intervention). In terms of reporting outcomes from the interventions, data extraction focused on data

that reported change in psychological symptoms both pre- and post-intervention (and at follow-up if available). Body mass index (BMI) data was not extracted. Effect sizes were reported if available. As many eating disorder treatment modalities view the family as an important part of the therapeutic process [35], data regarding parental involvement during the intervention was also extracted. In line with current scoping review guidance, risk of bias assessment was not completed [33] as the main aim of this review was to map the evidence available. For consistency, if intention to treat analyses (ITT) were available they were reported. It is worth noting that during the screening process, many studies focused on BED and BN together and did not report outcomes for the disorders separately meaning BED outcomes could not be reported.

Results

Study selection and characteristics

7852 studies were initially identified from the systematic search. Once duplicates had been removed both with support from Zotero software and manually, 4200 studies remained (see Fig. 1, PRISMA flow diagram).

Once screening according to the eligibility criteria was completed, a total of ten studies were considered eligible for this review and synthesised. Data for a total of 2400 young people are reported. Most studies (70%, 7/10) had a sample size of fewer than 100 participants. 80% (8/10) were carried out in the USA with the

Table 2 Methodologies of included studies

Study Type	Number of studies
RCT	8
Non-randomised comparison study	0
Case series	2

Table 3 Treatment modalities across the included studies

Treatment modality	Number of studies
Adapted interpersonal psychotherapy	3
Adapted cognitive behavioural therapy (CBT)	3
Adapted dialectical behaviour Therapy (DBT)	2
Group schema therapy	1
Medication	1
TOTAL	10

remaining two studies carried out in Iran and Germany. 80% (8/10) were published within the last ten years (2014-) with the remaining being published in 2009 and 2010. In terms of diagnosis, 70% (7/10) of studies used LOC eating or subthreshold BED as their inclusion criteria. The definition of 'LOC' or 'subthreshold' varied between studies. Two studies included those with BED only and one study was mixed with both BED and subthreshold BED. Of the ten studies included in the review, 60% (6/10) specified in their inclusion criteria that the children or adolescents should be overweight/over a certain BMI percentile. 80% (8/10) of studies were RCT, and 20% (2/10) were case series (see Table 2). See Tables 3 and 4 for a summary of the outcomes of the studies.

Narrative synthesis

Interventions: treatment modalities, population, setting and duration

Treatment modalities varied across all ten studies ranging from adapted DBT (2 studies) to group schema therapy (1 study). See Table 3 for further details. 60% (6/10) of interventions were group interventions, 30% (3/10) were individual interventions and 10% (1/10) was an intervention involving the parent-child dyad. In terms of parental involvement, 80% (8/10) of studies did not include direct parental involvement during the intervention. The ages of the children and adolescents included ranged from 8–19. Four studies had 100% female participants, five had majority female participants ($\geq 66\%$) and only one study had $< 50\%$ female participants

(46.7%). Three studies reported that most participants were Caucasian, and four studies did not report ethnicity. All studies were carried out in an outpatient treatment setting. Duration of intervention ranged from 8–16 weeks for all included studies apart from one study where medication (lisdexamfetamine) was the intervention. In this study, treatment duration averaged 19.1 months [36]. Aside from this study, all nine other studies offered weekly sessions in the intervention phase.

Outcomes: RCTs

Eight studies used an RCT design (Table 2). Three studies randomized participants to a psychological intervention or a waitlist control [37–39]. Three studies randomized participants to a psychological intervention or a health education group [40–42]. One study randomized participants to a psychological intervention or a weight management group [43] and one to CBT and two different types of exercise groups [44].

All RCTs used different interventions making direct comparisons challenging. 63% (5/8) used group interventions, 25% (2/8) used individual interventions and one used parent-child dyads as part of a family intervention. Three RCTs had more than 100 participants [37, 40, 44]. Jones et al., (n=105) randomized male and female adolescents from two high schools (mean age=15.1) to either an internet-facilitated intervention, Student Bodies 2-BED (n=52), or the waitlist control group (n=53) [37]. To be included the adolescents were required to be greater or equal to the 85th percentile for age-adjusted BMI and to have BED or subthreshold BED. The latter was defined as exhibiting binge eating or 'over-eating behaviours' ≥ 1 time per week in the previous 3 months. The internet intervention was an individual semi-structured programme which included psychoeducation and cognitive behavioural interventions based on the principles of Fairburn's CBT for BED [45]. From baseline to end of treatment, the number of objective binge eating episodes (OBEs) and subjective binge eating episodes (SBEs) decreased in both groups and this was significant in the intervention group (Mann Whitney U test (U_{81}): 565, $p < 0.01$). This was also true from baseline to follow-up (U_{84} : 562.5, $p < 0.05$). Weight and shape concerns decreased significantly among those who completed the intervention but not in the intention to treat analysis. No significant differences were noted in changes in objective overeating episodes (OOEs) or symptoms of depression in the intervention group. This was the same for OBEs, SBEs and OOE in the waitlist group. The authors suggested that this might represent the variable nature of binge eating which makes it difficult to objectively measure, leading to measurement errors [37]. It is worth noting there were low adherence

Table 4 Summary of findings for psychological interventions in BED and LOC eating in children and adolescents from included studies

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
RCTs Hilbert et al. 2019 [Germany]	RCT	WL	15.3	73	BED	Individual	20	4 months	EDE	EDE		Treatment drop out (< 10 sessions attended):
	Individual CBT (n=37) vs WL (n=36)		(2.5, nr)	F:82 E:nr					BE episodes: 11.8 (9.8) [CBT] 11.2 (8.9) [WL]	BE episodes: 1.3 (3.1) [CBT] 6 (8.6) [WL]	0.35**	9/37 (24%) [CBT] 14/36 (39%) [WL] Follow-up at 6, 12, 24 months, ITT analyses: BE episodes: F (6, 284): 46.3*** OBE episodes: F (6, 283): 31.0*** GEDP: F (6, 267): 36.4***
						CBT [OP]	[N]		OBE episodes: 7.9 (9.6) [CBT] 7.4 (7.4) [WL]	OBE episodes: 0.5 (1.7) [CBT] 3.6 (5.2) [WL]	0.38***	OBE episodes: F (6, 283): 31.0*** GEDP: F (6, 267): 36.4***
									GEDP: 2.3 (0.9) [CBT] 2.2 (0.8) [WL]	GEDP: 1.4 (0.9) [CBT] 2.0 (0.9) [WL]	0.34*	BDI-II: F (6, 260): 13.3*** RSES: F (6, 257): 12.9*** SF12-MQL: F (6, 242): 8.3***
									BDI-II: 14.3 (11.1) [CBT] 15.6 (10.1) [WL]	BDI-II: 12.2 (14.0) [CBT] 11.9 (10.9) [WL]	-0.05	
RCTs Jones et al. (2010) USA									RSES: 28.1 (7.0) [CBT] 27.1 (5.6) [WL]	RSES: 28.9 (9.3) [CBT] 27.9 (8.3) [WL]	0.02	
									SF12-MQL: 44.4 (13.8) [CBT] 42.6 (14.2) [WL]	SF12-MQL: 45.9 (15.7) [CBT] 42.6 (15.3) [WL]	0.08	
									-	Absence from BE: 19 (51) [CBT] 12 (33) [WL]	0.61*	
									Remission from BED: 21 (57) [CBT] 12 (33) [WL]	Remission from BED: 21 (57) [CBT] 12 (33) [WL]	0.67*	
									Binge eating	Binge eating	nr	16 (8 (15%) from each group) lost to follow-up at 3 months
RCTs Internet facilitated intervention "StudentBodies2-BED" (n=52) vs WL (n=53)												
	Internet facilitated intervention "StudentBodies2-BED" (n=52) vs WL (n=53)	WL	15.0	Total: 105 SB2-BED	≥ 85th percentile for age adjusted BMI Subthreshold BED	Individual internet facilitated semi structured programme based on CBT [OP]	16	16 weeks	Binge eating	OBEs/SBEs: 7.44 (17.89) [SB2-BED] 18.37 (22.63) [SR2-BED]	0.08	Binge eating

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Mazzeo et al. (2016) [USA]	RCT	Weight management group 28ft	WL	F:73	BED or LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	8.27 (17.75) [WL]	6.16 (16.10) [WL]	nr	9.0 (19.45) [SB2-BED]
			15.2 (1.1, nr)	E: 67					OOEs:	OOEs:		3.20 (8.92)* [WL]
	DBT style intervention LIBER8 (n = 28)	Weight management group 28ft	15.50 (1.64, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	8.75 (15.0) [SB2-BED]	3.98 (11.25) [SB2-BED]	nr	OOEs:
									7.78 (13.89) [WL]	3.63 (7.14) [WL]		3.69 (11.68) [SB2-BED]
	Or weight management 28ft (n = 17)	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	Weight and shape concerns	Mann Whitney U (U81): 565**	nr	1.43 (0.92) [WL]
									1.38 (0.84) [SB2-BED]	Weight and shape concerns		Mann Whitney U (U84): 562.5* (baseline to follow-up)
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	1.43 (0.92) [WL]	1.10 (0.72) [SB2-BED]	nr	Weight and shape concerns
									Depressed mood	1.24 (0.76) [WL]		1.0 (8.2) [SB2-BED]
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	16.62 (10.26) [SB2-BED]	Depressed mood	nr	1.25 (0.77) [WL]
									15.94 (10.49) [WL]	11.29 (9.76) [SB2-BED]		Depressed mood
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	13.22 (10.79) [WL]	13.22 (10.79) [WL]	nr	12.35 (11.57) [SB2-BED]
									EDE-Q	EDE-Q		11.16 (11.05) [WL]
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	Eating concern	Eating concern	nr	Post test (10, 36% [LIBER8], 4, 24% [28ft])
									1.92 (nr) [LIBER8]	1.05 (nr)* [LIBER8]		3 months (16, 57% [LIBER8], 6, 35% [28ft])
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	1.90 (nr) [28ft]	0.70 (nr)* [28ft]	nr	3 month follow-up data not reported
									Shape concern	Shape concern		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	3.32 (nr) [LIBER8]	2.44 (nr)* [LIBER8]	nr	
									2.88 (nr) [28ft]	1.76 (nr)** [28ft]		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	Weight concern	Weight concern	nr	
									3.33 (nr) [LIBER8]	2.72 (nr)* [LIBER8]		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	2.96 (nr) [28ft]	2.13 (nr)** [28ft]	nr	
									Restraint	Restraint		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	1.54 (nr) [LIBER8]	1.00 (nr)* [LIBER8]	nr	
									1.65 (nr) [28ft]	1.20 (nr)* [28ft]		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	Total	Total	nr	
									2.53 (nr) [LIBER8]	1.74 (nr)* [LIBER8]		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	2.24 (nr) [28ft]	1.37 (nr)** [28ft]	nr	
									EES-C	EES-C		
	For 3/5 waves	Weight management group 28ft	15.29 (1.90, nr)	E: 44	LOC eating	DBT based group intervention	Wave 1 = 12 subsequent waves = 8 waves: 8 weeks [N]	Wave 1: 12 weeks	Anxiety, anger, frustration	Anxiety, anger, frustration	nr	
									0.91 (nr) [LIBER8]	0.82 (nr) [LIBER8]		

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Mehlenbeck et al. (2009) [USA]	RCT	n/a	<u>Study 1</u>	<u>Study 1</u>	Overweight	<u>Study 1+2</u> CBT + PEAT/ CBT + EXER	16	<u>Study 1+2</u>	1.14 (nr) [28Fit]	0.68 (nr)* [28Fit]	nr	<u>Study 1</u>
									Depressive sx	Depressive sx		
	<u>Study 1</u> (CBT + PEAT vs CBT + EXER)		14.51	76	subthreshold BED	CBT was group focused [OP]	[Y]	16 week intervention	1.71 (nr) [LIBER8]	1.38 (nr) [LIBER8]		18% dropped out before completion <u>Study 2</u>
									2.10 (nr) [28Fit]	1.62 (nr)** [28Fit]		
	Focused on dietary exchanges <u>Study 2</u>		(0.93, 13–16)	F: 71.1 E: 78.9					Feeling unsettled	Feeling unsettled		15% dropped out before completion No follow-up in either study
									1.28 (nr) [LIBER8]	0.87 (nr) [LIBER8]		
	<u>Study 2</u> (CBT + PEAT vs CBT + EXER)		14.33 (0.99, 13–16)	F: 68.1 E: 78.0					1.32 (nr) [28Fit]	1.04 (nr) [28Fit]		15% dropped out before completion No follow-up in either study
									EAH	EAH		
	Focused on calorie restriction								Negative affect	Negative affect		
									1.07 (nr) [LIBER8]	0.87 (nr)** [LIBER8]		
									1.24 (nr) [28Fit]	0.90 (nr) [28Fit]		
									External	External		
									2.15 (nr) [LIBER8]	2.10 (nr) [LIBER8]		
									2.15 (nr) [28Fit]	2.04 (nr) [28Fit]		
									Fatigue	Fatigue		
									1.65 (nr) [LIBER8]	1.54 (nr) [LIBER8]		
									1.87 (nr) [28Fit]	1.46 (nr) [28Fit]		
									BES	BES		
									Correlation	Correlation		
									SPP social acceptance	SPP social acceptance		
									-.191 [study 1]	.085 [study 1]		
									-.139 [study 2]	.165 [study 2]		
									SPP athletic competence	SPP athletic competence		
									-.445** [study 1]	.285** [study 1]		
									.025 [study 2]	-.019 [study 2]		
									SPP physical appearance	SPP physical appearance		
									-.428** [study 1]	.404** [study 1]		
									-.424** [study 2]	.277** [study 2]		
									SPP global self worth	SPP global self worth		
									-.482** [study 1]	.421** [study 1]		
									-.504** [study 2]	.300** [study 2]		

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Saravi et al. (2020), [Iran]	Quasi experimental RCT	WL	Group schema therapy	30	Score 17 or above on BE scale	Group schema therapy	13	13 weeks	Physical self-worth -41.1** [study 1] -310** [study 2]	Physical self-worth .415** [study 1] .199* [study 2]		Drops outs: nr
		Group schema therapy (n = 15) vs WL (n = 15)	15.47	F:100	BMI of 25–29.9		[N]		SR	SR		Follow-up at 3 months
		(nr, 15–17)		E: nr					Control: 200.40 (29.722)	Control: 199.80 (29.979)		SR
		WL	15.53						EA GS: 20.60 (6.895)	EA GS: 13.93 (6.681)		GS: 268.07 (28.106) Control: 199.80 (29.881)
Shomaker et al. (2017) [USA]	RC pilot trial	Family based health education (FB-HE)	(nr, 15–17)						Control: 23.67 (9.832)	Control: 23.80 (9.937)		EA GS: 14.20 (8.906)
									Repeated measures analysis of variance	Repeated measures analysis of variance		Control: 23.60 (9.311)
	FB-IPT (n = 15) vs FB-HE (n = 14)	Family based health education (FB-HE)	FB-IPT	Total: 29	BMI ≥ 85th percentile	Family based interpersonal psychotherapy (parent child dyads)	12	12 weeks	Time: Self regulation F 11.465* Eating attitude F 15.80*	Time: Self regulation F 11.465* Eating attitude F 15.80*	0.804 0.361	
									Time Group: Self regulation F 11.630* Eating attitude F 16.18*	Time Group: Self regulation F 11.630* Eating attitude F 16.18*	0.804 0.366	Dropouts:
									Social problems	Changes post intervention:		
									1.6 (0.3) [FB-IPT]	Δ Social problems	0.30	Post treatment (27% [FB-IPT], 14% [FB-HE])
			FB-HE	15	≥ 1 LOC eating episode in a month		[Y]		1.6 (0.4) [FB-HE]	0.01 [FB-IPT], 0.20 [FB-HE]		6 months (40% [FB-IPT], 36% [FB-HE]) 1 year (53% [FB-IPT], 43% [FB-HE])
									Depression symptoms	Δ Depression		6 months
									7.0 (4.1) [FB-IPT] 8.4 (4.8) [FB-HE]	-3.96 [FB-IPT], 0.66 [FB-HE] Δ Anxiety	1.23**	Δ Social problems -0.11 [FB-IPT], 0.18 [FB-HE]
									Anxiety symptoms	-3.64 [FB-IPT], -0.25 [FB-HE]	0.79**	Δ Depression -3.33 [FB-IPT], -2.27 [FB-HE]
									30.8 (5.9) [FB-IPT]			Δ Anxiety -6.07 [FB-IPT], -0.42 [FB-HE]

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Tanofsky-Kraff et al. (2014)	RCT	HE	14.5	Total: 113	High risk of obesity (BMI: 75th–97th percentile)	Group adapted interpersonal psychotherapy	1.5 h individual session	12 weeks	34.7 (5.9) [FB-HE]	Reported graphically so unable to tabulate	nr	<p>Δ disordered eating -0.82 [FB-IPT], -0.43 [FB-HE]</p> <p>12 months</p> <p>Δ Social problems -0.16 [FB-IPT], -0.10 [FB-HE]</p> <p>Δ Depression -4.42 [FB-IPT], -0.20 [FB-HE]</p> <p>Δ Anxiety 2.97 [FB-IPT], -4.61 [FB-HE]</p> <p>Δ disordered eating -0.92 [FB-IPT], -0.91 [FB-HE]</p> <p>Dropout after:</p>
[USA]	IPT (n=55) vs HE (n=58)		(1.7, 12–17)	IPT	LOC eating		12 group sessions [N]		4.7 (nr) [IPT]			12 weeks (3.5–5% [IPT], 5, 8.6% [HE])
				55	Not BED				8.0 (nr) [HE]			6 months (4, 7.2% [IPT], 6, 10.3% [HE])
				F: 100	32.7% reported BE				Binge episodes			12 months (6, 10.9% [IPT], 9, 15.5% [HE])
				E: 52.7					0.4 (nr) [IPT]			12 months
				HE					0.8 (nr) [HE]			Binge episodes
				58					Depressive symptoms			0.4 (SE=0.00, 0.09) [IPT]
				F: 100					10.1 (6.9) [IPT]			0.16 (SE=0.14, 0.23) [HE] *
				E: 60.3					11.2 (6.3) [HE]			LOC episodes:
									Anxiety symptoms			F (3, 310)=78.33***, No group by interval effect
									33.3 (7.1) [IPT]			Depressive symptoms
									34.9 (6.3) [HE]			F (3, 315)=37.54***, No group/group by interval effect
												Anxiety symptoms
												F (3, 311)=9.06***, No group/group by interval effect

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Tanořky-Kraff et al. (2016) [USA] CASE	RCT	HE	IPT 14.1 (1.5, nr)	IPT	BMI between 75 and 95th percentiles	Group adapted interpersonal psychotherapy	1.5 h individual session	12 weeks	Pre-meal BRUMS (mean, SE)	Followed up at 6 months and 1 year	nr	4% dropped out before test meal at baseline
	IPT (n = 46)		HE 14.7	46	LOC eating in the past month		12 group sessions		Anger			22% dropped out before final follow-up
	vs HE (n = 42)		(1.8, nr)	F: 100			[N]		45.8 (0.8) [IPT]			Pre-meal BRUMS 6 months, 1 year (mean, SE)
				E: 24 HE					46.2 (0.8) [HE] Depression			Anger 45.3 (0.5), 44.3 (0.2) [IPT]
				42					44.9 (0.4) [IPT]			45.6 (0.6), 45.4 (0.5) [HE]
Case series Guerdjikova et al. (2019) [USA]				F: 100 E: 22					45.5 (0.5) [HE] Tension			Depression 44.5 (0.2), 44.2 (0.1) [IPT]
									45.3 (0.7) [IPT]			44.3 (0.1), 45.5 (0.6) [HE]
									45.3 (0.8) [HE]			Tension 44.0 (0.6), 42.5 (0.4) [IPT]
												45.1 (0.9), 44.3 (0.8) [HE]
												No follow-up
Case series Guerdjikova et al. (2019) [USA]	Retrospective chart review	n/a	16.5	25	BED	Medication (LDX)	n/a	19.1 months (mean)	Mean maximum dose of LDX 58.0 mg/d (SD 15 mg/d)	Complete remission of symptoms (16%)	nr	
			(nr, 10–19)	F: 72			[N]	13.8 (SD)	36% received concurrent psychotherapy for BED whilst on LDX	Reduction in binge eating frequency/improvement in binge eating symptoms (24%)		
				E: nr					12% also on aripiprazole			
										Likely to binge if LDX skipped (8%) Less frequent sneaking of food (4%) Binge eating occasionally in response to increased stress (8%) No response (16%) Worsening of BED symptoms (8%)		

Table 4 (continued)

Author & Place	Design	Control group	Mean age (sd, range)	N % female, ethnicity % Caucasian	Diagnosis	Treatment modality [setting]	# sessions [parents involved]	Tx length	Baseline Data mean (sd) or as otherwise reported	End of Treatment Data (mean, sd) or as otherwise reported	ES	Dropout & Follow-Up Data
Kamody et al. (2019) [USA]	pilot trial	n/a	15.4 (1.30, 14–18)	15 F: 73 E: nr	Subthreshold BED	Condensed DBT skills group	10 [N]	10 weeks	Met criteria for BED: 6/15, 40% OBE (youth): (3.67, 4.95) OBE (caregiver): (4.47, 6.02) EO (youth): (48.80, 21.33) EO (caregiver): (63.47, 22.70)	No description of response (16%) Met criteria for BED: 3/15, 20% OBE (youth): (2.13, nr) OBE (caregiver): (1.53, nr) EO (youth): (45.87, nr) EO (caregiver): (55.33, nr)	nr	Drop outs: baseline measures to intervention: 15, 50% at 3 months: 4, 27% Follow-up at 3 months: Met criteria for BED: 1/11, 9% OBE (youth): (1.36, nr) OBE (caregiver): (1.09, nr) EO (youth): (39.27, nr) EO (caregiver): (41.09, nr)

rates to this study (for example, mean number of screens viewed on the programme was 20.2 out of a possible 104).

Two other RCTs also used CBT-based interventions [38, 44]. Hilbert et al. randomized 73 adolescents (mean age: 15.3) to age-adapted CBT ($n=37$) or a waiting list (WL) ($n=36$). Binge eating episodes, elicited from the Eating Disorders Examination (EDE), significantly reduced in the intention to treat analysis, with a mean of 4.7 ($p<0.01$) fewer monthly binge eating episodes in the CBT compared to the WL group. They also noted higher rates of abstinence from binge eating, higher rates of remission from BED and lower eating disorder psychopathology on the EDE (all $p<0.05$) at post-assessment in the CBT group. Symptoms of depression, quality of life and self-esteem did not change in either group. At 6-, 12- and 24-month follow-up from the CBT intervention, binge eating episodes remained significantly reduced ($p<0.001$) compared to baseline.

Mehlenbeck et al. carried out two RCTs to investigate binge eating symptoms following participation in a behavioural weight control intervention [44]. In addition to weight data, they reported psychological measures such as self-worth and social acceptance, hence inclusion in this review. Inclusion criteria for the studies were to report subthreshold binge eating symptoms and to be 20–80% overweight by BMI (study 1) and 30–90% overweight by BMI (study 2). In both RCTs, adolescents were assigned to a ‘CBT +’ intervention exercise programme (1. CBT + peer enhanced adventure therapy (PEAT) or 2. CBT + aerobic exercise (EXER)). These involved a dietary and exercise prescription along with behavioural strategies. The behavioural topics covered included portion control, problem-solving, motivation and self-monitoring of diet and exercise. The peer-based activity was designed to increase teamwork and social skills whilst the aerobic exercise was purely focused on exercise. In study 1, the weight control intervention was based on food type and serving size. In study 2, it was based on calorie restriction (1400–1600 cal/day). All other parts of the interventions were identical. Parents also attended a separate weekly parental group. In both studies, results indicated a significant reduction in binge eating symptoms assessed using the Binge Eating Scale [44]. In study 1, baseline global and physical appearance, self-concept and physical worth were positively associated with changes in binge eating symptoms. Global self-concept was negatively associated with changes in binge eating symptoms. In study 2, a negative relationship was observed between changes in dimensions of self-concept and binge eating symptoms, meaning improved physical appearance, global self-concept, and physical self-worth at the end of treatment were associated with a decrease in endorsement of binge eating symptoms. Decreases in binge eating scores

were related to improvements in several dimensions of self-concept including global self-worth (both studies 1 and 2) and physical appearance and self-worth (study 2). This relationship is suggestive that those who binge-eat less, feel better about themselves or those who feel better about themselves are less likely to binge-eat.

Three RCTs used adaptations of interpersonal psychotherapy (IPT) as their main intervention. The largest of these studies ($n=113$) was carried out by Tanofsky-Kraff et al. in 2014. 55 adolescent females were randomized to IPT and 58 to a health education (HE) group. Inclusion for the study was a BMI between the 75th and 97th percentile and LOC eating, defined as 1 episode of LOC in the past month [40]. 32.7% also reported binge eating. Results were mixed with symptoms of anxiety, depression and episodes of LOC eating at the 12-month follow-up significantly reduced in both groups ($p<0.001$). However, at 12-month follow-up, IPT was more helpful than HE in reducing objective binge eating ($p<0.05$). Also, girls of ethnic-racial minorities (majority African-American), if they were assigned to IPT, experienced significantly greater reductions in LOC episodes at 1-year follow-up than those assigned to HE.

In 2016, Tanofsky-Kraff et al. randomized 88 adolescent girls (aged 12–17) to IPT ($n=46$) or HE ($n=42$) [41]. At baseline, 6-month and 12-month follow-up, participants ate a lunch designed to simulate LOC eating in a laboratory. The treatment started after the baseline lunch and consisted of a 1.5-h individual session and 12 weekly group sessions. They found that those who participated in the IPT group had a significant decrease in pre-meal tension and anger at 1-year follow-up. The authors suggested that perhaps IPT may reduce the negative affect linked to LOC eating proposed by affect theory [15]. In terms of depressive mood, they found those randomized to IPT experienced no change in pre-meal depression whereas those in HE by follow-up at 1 year had an increase in pre-meal depressive symptoms.

In the third study, Shomaker et al. used a family-based IPT intervention (FB-IPT) consisting of parent–child dyads ($n=15$) and a family-based health education group (FB-HE) as the control ($n=14$). They hypothesized that underlying parent–child communication difficulties may contribute to LOC eating as the latter often occurs in response to negative affect [20]. Outcomes were measured directly post-intervention and at 6- and 12-month follow-up. The study found that a greater decrease in LOC eating at end of treatment was observed following FB-IPT compared to the FB-HE (38% versus 77%, $p<0.05$) [42]. However, there were no differences between groups at either 6- and 12-month follow-up. Global disordered eating attitudes did decrease from baseline to follow-up, and at 6 months this was more

pronounced with the FB-IPT group. However, at 12 months, all children had decreased global disordered eating attitudes ($ps<0.001$) with no difference between the interventions ($p=0.97$). They also found that the dyads who had been randomized to FB-IPT had decreased depressive symptoms ($p<0.01$). This was noted in both treatments at 6-month follow-up, with no differences between treatments ($p=0.47$). At 1-year follow-up, it was FB-IPT that appeared to demonstrate a long-standing impact on a reduction in depressive symptoms ($p<0.01$). The FB-IPT intervention also demonstrated a significant effect on reduction in anxiety at post-treatment ($p<0.001$) and at the 6-month follow-up ($p<0.01$) unlike the FB-HE intervention. However, at 1 year neither intervention showed significant change from baseline in terms of anxiety reduction. The study also examined social adjustment and found that at all follow-up points, there was no significant improvement in either intervention. It is worth noting that in this study at baseline measurements, the average LOC episodes per month were small for both the FB-IPT and FB-HE groups, 3.1 and 2.6 respectively [42].

Other treatment modalities studied in the other included RCTs were group schema therapy [39] and adapted dialectical behaviour therapy (DBT). Saravi et al. examined the effects of group schema therapy ($n=15$) vs a waitlist control ($n=15$) for female adolescents (aged 15–17) with BMIs between 25–29.9 and who scored 17 or above on the Binge Eating Scale [46]. They noted a significant improvement in mean scores of eating attitudes both immediately post-treatment and at 3-month follow-up for those randomized to the group schema therapy intervention. They also reported a significant improvement in self-regulation and eating attitude in the schema therapy group compared to the control group ($p<0.05$).

Mazzeo et al. randomized to ‘LIBER8’ (Linking Individuals Being Emotionally Real) ($n=28$) or ‘2BFit’ ($n=17$) for three out of five waves of their study. ‘LIBER8’ is a 12-week, weekly group intervention based on CBT principles with integrated DBT skills training and ‘2BFit’ is a behaviourally based weight management group where participants are set individualized diet and exercise goals with sessions to check adherence to goals and discuss potential barriers to achieving these [47]. For the final two waves, they did not run the weight management group (due to difficulties in recruitment). The participants met the criteria for LOC eating or BED. Both LIBER8 and 2BFit groups demonstrated significant improvements ($p<0.05$) pre- and post-intervention on the Eating Disorder Examination Questionnaire (EDE-Q), eating concern, shape concern, restraint, and global score. The 2BFit group also reported significant

improvements in the EDE-Q weight concern score compared to the LIBER8 group.

In terms of broader mental health symptoms, assessed by the Emotional Eating Scale for Children (EES-C) [48] in the domains of anxiety, anger and frustration, depressive symptoms and feeling unsettled, no significant differences were observed between groups. Pairwise comparisons revealed significant improvements in the 2BFit group in the areas of anxiety, anger and frustration and depressive symptoms ($p < 0.05$), whereas no significant changes in any of the domains were observed in the LIBER8 group. A significant reduction in negative affect pre- and post-intervention was observed for LIBER8 ($p < 0.007$) but not for the 2BFit group.

Outcomes: case series

Two of the included studies were case series. One evaluated the impact of a condensed DBT skills group [49] and the other the impact of medication [36]. The latter was the only study identified that described the impact of medication on BED in adolescence and childhood. Kamody et al. [49] included 15 14–18-year-old adolescents who attended a 10-week DBT skills group. To be eligible they had to meet at least one of the DSM-V criteria for BED. Of those that completed the baseline measurements only 50% (15/30) went on to complete the intervention. Among the intervention completers, those meeting diagnostic criteria for BED decreased from six (40%) at baseline to three (20%) post-treatment. Of those who completed the 3-month follow-up ($n = 11$), only one met criteria for BED. The study also reported on OBE and emotional overeating (EO) via the Eating Disorder Examination Questionnaire (EDE-Q) and the Emotional Eating Scale for Children and Adolescents (EES-C) respectively. These were given to both the young people and their caregivers. OBE and EO frequency reported by both young people and their caregivers decreased following the intervention at both post-treatment and at 3-month follow-up.

In the other case series, a retrospective chart review was carried out of 25 young people (aged 10–19, mean age 16.5) with a diagnosis of BED who were prescribed lisdexamfetamine [36]. The mean duration of treatment was 19.1 months, 36% (9/25) were receiving concurrent psychotherapy for BED and 12% (3/25) were also on aripiprazole at the time of treatment. 16% (4/25) reported complete remission of their symptoms, 24% (6/25) reported an improvement in their binge eating frequency, 4% (1/25) less frequent sneaking of food and 8% (2/25) were likely to binge if lisdexamfetamine skipped. 16% (4/25) reported no response to medication and 8% (2/25) reported a worsening of their symptoms.

Diagrammatic synthesis

Table 5 presents a synthesis of the different treatment modalities from the ten included studies and their impact at end of treatment on psychological symptoms in BED. The end-of-treatment effect was chosen as the endpoint due to the heterogeneity of follow-up amongst the included studies. However, it is important to note that the IPT interventions reported on follow-up data, so their results are included in the table in brackets, for comparison. 6 treatment modalities [7 studies] were suggestive of an improvement in binge eating episodes or LOC eating following their intervention, with both individual CBT studies noting an improvement following participation. As discussed above, the FB-IPT intervention noted improvement post-treatment but found no difference between groups at 6- and 12- month follow-up [42]. Table 5 also demonstrates that many different areas of psychological symptoms were explored in these studies although findings are heterogeneous.

Discussion

In this systematic scoping review, ten papers were identified that report on the outcomes of interventions aimed at improving psychological symptoms for children and adolescents with BED and LOC eating. The findings highlight a paucity of research in this area, both in terms of the age range studied and outcomes. The dearth of studies focusing on psychological symptoms and psychopathology as outcomes is of particular note, with most studies focusing on BMI or weight loss. Studies included were mostly small in terms of number of participants and heterogeneous in terms of the treatment modalities used and the psychological symptoms assessed (see Table 5). At best, it can be said that all treatment modalities showed some evidence of improving psychological symptoms (see Table 5) but more studies with larger samples are sorely needed.

As stated in the introduction to this review, owing to the minimal studies in adolescents purely focused on BED, studies focused on LOC eating were considered also. It is also worth reiterating that in the screening process, many studies focused on BED and BN together without reporting outcomes for each group separately. Only two studies identified in this review included full-syndrome BED as an inclusion criterion. These findings highlight the importance of further research in this population, especially given BED is estimated to be the most prevalent eating disorder amongst young people [1].

The findings from this review provide very preliminary, weak evidence for 6 different treatment modalities that may be associated with a reduction in binge eating episodes and LOC eating for children and adolescents. These are CBT (group and individual), IPT, DBT,

FB-IPT and medication. In terms of other psychological symptoms, such as depression and anxiety, the data were sparse, and it is difficult to draw meaningful conclusions.

Like in adult studies of BED, treatment modalities piloted with adolescents included CBT, IPT, DBT and medication. Group schema therapy was also one intervention included, which emphasizes changing maladaptive coping styles and maladaptive schemas formed in childhood [39]. In previous research, it has been reported that people in larger bodies with BED have significantly higher scores in certain schemas (abandonment/instability, emotional deprivation, and inadequate self-control/self-discipline) than those in larger bodies without BED (Moloodi et al., 2010). Saravi et al. (2020) hypothesized that when schemas are activated due to negative emotions, emotional regulation is more difficult so schema therapy can help improve self-regulation. Their results did show an improvement in eating attitudes and self-regulation over time for their schema therapy intervention [39].

Hilbert et al.'s RCT demonstrated the potential longer-term effectiveness of CBT as an intervention for BED. This is one of the only studies included where the inclusion criteria for the study was a DSM IV-TR or DSM V diagnosis of BED [50].

One intervention unique to children and adolescents used in the studies identified was FB-IPT [42]. FB-IPT developed as a treatment approach for preadolescent depression [51]. Compared to preadolescents without LOC, preadolescents with LOC eating have less healthy familial communication [52]. The FB-IPT intervention appeared to show promise in demonstrating a longstanding impact on a reduction in depressive symptoms at the 1-year follow-up but showed no significant results for BED or related difficulties after post-treatment. As family-based therapy is typically the first line treatment for other child and adolescent eating disorders, for example, AN and BN [53, 54] this is somewhat surprising. This may be more of a reflection of the need to consider *how* to involve families in the treatment for BED and LOC eating rather than whether to involve them at all. Family therapy interventions are unique to children and as far as the researchers are aware, have not been evaluated in adult BED. With the reported association between LOC eating and family communication, this is an important area for further research [52].

In the 8 RCTs included, 3 randomised participants to a waitlist control [37, 39, 50] and 5 randomised to active control interventions [40–44], which included health education, weight management and exercise groups. It is worth noting that some of these 'active control groups' had significant results and were not always psychological treatments. In Tanofsky-Kraff et al. (2014) symptoms

of anxiety and depression and episodes of LOC eating at the 12-month follow-up significantly reduced in both the HE group and the IPT intervention [40]. For Mazzeo et al. both the DBT and 2BFit group (weight management active control group focusing on nutrition and exercise habits) demonstrated significant improvements pre- and post-intervention on eating disorder psychopathology (EDE-Q; eating concern, shape concern, restraint, global score). However, the active control group also reported significant improvements in the EDE-Q weight concern score. In terms of mood symptoms, there were significant changes in the active control group in the areas of anxiety, anger and frustration and depressive symptoms. This highlights the importance of considering the associated benefits of an intervention, for example; both the intervention and active control groups may provide social support and cohesion which is known to improve mood [41, 55].

It is apparent from reviewing the literature that there is a recent increase in interest in BED and its development and maintenance, despite the lack of reported outcome data. A few case studies were identified that focused on family therapy. Additionally, several small pilot studies also noted the role of exposure work in binge eating treatment, however, studies were excluded as they did not meet the inclusion criteria (case studies, no statistical analysis, or over age limit). Nevertheless, they suggest a burgeoning interest in novel treatments for BED and LOC eating, which is much needed.

Regarding medications for BED and LOC eating, only one study was identified by the search strategy. Several have been trialled on adults [7] with only a few case reports noted for the use of medications in childhood and adolescence [56, 57]. This was also noted anecdotally during the screening process, where papers discussing medication use were predominantly focused on adults. The medication used in the included study in this review, lisdexamfetamine, has been licensed for use in adults with BED in the USA by the U.S. Food and Drug Administration (FDA) since 2015 [22]. It is only currently licensed for Attention Deficit Hyperactivity Disorder (ADHD) in children and adults in the UK [58]. There is some evidence that ADHD and LOC eating may be related to each other in terms of impulsivity [59] and some evidence of an association between BED and ADHD [60]. Weight loss has been demonstrated in adults from use of lisdexamfetamine [61] but results regarding mood and eating disorder psychopathology are limited. Furthermore, adverse effects need to be carefully monitored [7]. The case series included in this review had a small number of participants (N=25) [36]. Results were mixed with 16% (4/25) reporting complete remission of their symptoms, 24% (6/25) reporting an improvement

Table 5 Diagrammatic synthesis of treatment modalities and the end-of-treatment impact on psychological symptoms in BED

Treatment modality* (no. of studies)	Outcome							
	binge eating episodes (OBE/SBE) / LOC eating	Depressive symptoms	Anxiety	Other mood concerns**	Self- esteem/ QOL ***	ED*** psychopathology	Remission from BED	Abstinence from BED
IPT (2)****	(✓)●	(✓) (X)	(✓) (X)	●(✓)	●●	●●	●●	●●
FB-IPT (1)	✓	✓	✓	●	●	●	●	●
DBT (2)	● ✓	X ●	X ●	✓ ●	●●	✓●	●●	●●
Individual CBT (2)	✓ ✓	X X	●●	●●	X ●	✓●	✓●	✓●
Group CBT (1)	✓	●	●	●	✓	●	●	●
Group schema therapy (1)	●	●	●	●	●	✓	●	●
Medication (1)	✓	●	●	●	●	●	✓	●

Key: ✓ suggestive of improvement/suggestive of improvement relative to control, X not suggestive of improvement/ not suggestive of improvement relative to control, : not reported/assessed

* Note: treatment modalities were adapted for each study, ** Pre-meal tension and anger (IPT), negative affect (DBT), *** ED: Eating Disorder, QOL: Quality of life,

****Only follow-up data was reported, results shown in brackets here for comparison, *p<0.05, **p<0.01, ***p<0.001

in their binge eating frequency but 16% (4/25) reporting no response to medication and 8% (2/25) reporting a worsening of their symptoms.

More than half the studies (60%, 6/10) reported weight loss or change in BMI as an outcome in addition to changes in psychological symptoms. Additionally, several studies had a higher BMI as an inclusion criterion and several included weight management and exercise support as part of their main intervention, control group, or both. Given BED is a psychological, not a physical health condition, there is concern described in the literature that the inclusion of weight management interventions and/or weight loss targets only reinforces weight stigma [62]. As noted by Grucza et al. [10] the psychological impact of BED is present regardless of BMI or body weight, suggesting that it is binge eating and its associated distress that are key when considering the clinical impairment of this disorder. This is not to say that internalized weight stigma, body image concerns and psychopathology are not interrelated for many. A recent systematic review [63] focused on the impact of weight loss interventions on binge/LOC eating in children and adolescents and found that weight loss interventions did result in a significant decline in binge/LOC eating (95% of studies). However, they noted that these studies were limited in their lack of reporting of changes on an individual level and that the one study that did assess on an individual level found that whilst binge eating prevalence decreased from 24 to 3%, four patients developed new binge eating behaviours during the study [63]. This highlights that the relationship between weight and binge/LOC eating is complex and needs to be carefully considered in future research.

Given evidence for the Health at Every Size (HAES) movement [29] and continually emerging evidence of the harm and confusion caused by conflating weight loss for people in bigger bodies with psychological treatment for people with BED, LOC eating and related eating disorders, it is important to try and distinguish and better understand the interplay between weight and psychological symptoms moving forward.

Limitations

There are some key limitations to this review. Firstly, the exclusion criteria. Only English language papers were reviewed so a Western perspective taken. Furthermore, editorials, non-peer reviewed books and book chapters were excluded along with conference reports. To make the review more feasible, owing to the lack of available studies, the scope of the review had to be widened to include LOC eating. In terms of studies identified, they were small with the majority having under 100 participants. Most participants were female. Statistical analyses, heterogeneity in follow-up periods and components of psychological symptoms were varied so it was difficult to draw comparisons. Furthermore, LOC eating was defined variably throughout all studies and only one study had BED diagnosis as an inclusion criterion. While this allowed for analysis of both BED and LOC behaviours, it is important to note that these are different concepts and therefore would benefit from separate analysis. The time limit of this review meant that RCTs currently registered but not completed on the Cochrane database, CENTRAL could not be included, for example, [64]. Therefore, the findings are only up to date until 23rd August 2024.

Lastly, the review did not use statistical tests and in line with current scoping review guidance did not fully assess bias [33].

Conclusions

This systematic scoping review highlights the paucity of research for interventions to improve psychological symptoms in BED and LOC eating in the child and adolescent population. The aims were achieved as the extent of the knowledge currently available in this field was mapped and the existing gaps in knowledge identified. This is an emerging and important field in child and adolescent eating disorders as it is the most prevalent eating disorder in this population, and it is now ten years since BED became its own diagnostic entity in the DSM-V. Added to this as discussed previously, its impact on the physical and mental health of those affected is significant. As the onset of binge eating often occurs in late childhood or adolescence [12] there is a role for early intervention [65].

The above limitations and small number of studies included, make conclusions from this review tentative but it still serves to raise important questions about the focus on treatment for BED and the need for further studies. Given the varied treatment modalities and limited number and size of studies, more research into the different therapeutic options would be beneficial, including the less well-known modalities such as FB-IPT and group schema therapy. Further work into the role of the family and medication would also be beneficial. Lastly, more definitive descriptors for LOC eating and BE would allow for a more defined research population.

Abbreviations

ADHD	Attention Deficit Hyperactivity Disorder
AN	Anorexia nervosa
BED	Binge eating disorder
BMI	Body mass index
BN	Bulimia nervosa
CBT	Cognitive Behavioural Therapy
DBT	Dialectical Behavioural Therapy
DSM-IV/V	Diagnostic Statistical Manual of Mental Disorders (4th/5.th edition)
ED	Eating disorder
EDE-Q	Eating Disorder Examination Questionnaire
EES-C	Emotional Eating Scale for children
EO	Emotional overeating
EXER	Aerobic exercise
FB- HE	Family-based health education
FB-IPT	Family-based Interpersonal Psychotherapy
FDA	United States Food and Drug Administration
HAES	Health at Every Size
HE	Health education
IPT	Interpersonal Psychotherapy
ITT	Intention to treat analyses
LOC	Loss of control eating
OBE	Objective binge eating episodes
OOE	Objective overeating episode
OSFED-BED	Other specified feeding and eating disorders- binge eating disorder

PEAT	Peer enhanced adventure therapy
PICO	Population, intervention, comparison, outcomes
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta Analyses
QOL	Quality of Life
RCT	Randomised controlled trial
SBE	Subjective binge eating episodes
SSRI	Serotonin reuptake inhibitors
WL	Waitlist
ACBC	Achenbach Child Behaviour Checklist
BDI-II	Beck Depression Inventory
BED	Binge eating disorder
BES	Binge eating score
BN	Bulimia Nervosa
BRUMS	Brunel mood scale
CBT	Cognitive behavioural therapy
CBT-E	Enhanced cognitive behavioural therapy
CBT+PEAT	Cognitive behavioural therapy w/peer enhanced adventure therapy
CBT+EXER	Cognitive behavioural therapy w/aerobic exercise
DBT	Dialectical behavioural therapy
EA	Eating attitude
EAH	Eating in the absence of hunger
ED	Eating Disorder
EDE 17.0	Eating disorders Examination
EDE-Q	Eating disorder examination questionnaire
EES-C	Emotional eating scale for children
EO	Emotional Overeating
FBT	Family based therapy
FB-IPT	Family based interpersonal therapy
FB-HE	Family based health education
GEDP	Global eating disorder pathology
LDX	Lisdexamfetamine
LOC	Loss of control eating
NR	Not reported
OBE	Objective binge eating episode
OOE	Objective overeating episode
OP	Outpatient
RBE	Recurrent binge eating
RCT	Randomised control trial
RSES	Rosenberg self esteem scale
SBE	Subjective binge eating episode
SE	Standard error
SF12- MQL	SF12- Mental Quality of Life
SPP	Self perception profile
SR	Self regulation
WL	Waiting list

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40337-025-01206-0>.

Supplementary material 1

Acknowledgements

PLB would like to acknowledge her in utero 'co-author' who despite being term, generously stayed put until she had finished writing this review.

Author contributions

PLB is first author and devised the research question, carried out the search and wrote the initial draft of the review. JB is second reviewer and provided invaluable guidance during the process and read through and provided advice on the manuscript. Both authors reviewed the manuscript prior to submission.

Funding

No funding was required to carry out this systematic scoping review.

Availability of data and materials

All the data is provided within the manuscript or supplementary information files.

Declarations**Ethics approval and consent to participate Not applicable.**

Consent for publication Not applicable.

Competing interests

The authors declare no competing interests.

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Received: 25 October 2024 Accepted: 26 January 2025

Published online: 10 March 2025

References

- Nicholls D, Barrett E. Eating disorders in children and adolescents. *BJPsych Adv*. 2015;1(21):206–16.
- Marzilli E, Cerniglia L, Cimino S. A narrative review of binge eating disorder in adolescence: prevalence, impact, and psychological treatment strategies. *Adolesc Health Med Ther*. 2018;9(101576821):17–30.
- Kjeldbjerg ML, Clausen L. Prevalence of binge-eating disorder among children and adolescents: a systematic review and meta-analysis. *Eur Child Adolesc Psychiatry*. 2023;32(4):549–74.
- Udo T, Grilo CM. Prevalence and correlates of DSM-5-Defined eating disorders in a nationally representative sample of U.S. Adults *Biol Psychiatry*. 2018;84(5):345–54.
- Smink FRE, van Hoeken D, Oldehinkel AJ, Hoek HW. Prevalence and severity of DSM-5 eating disorders in a community cohort of adolescents. *Int J Eat Disord*. 2014;47(6):610–9.
- Diagnostic and Statistical Manual of Mental Disorders. 5th ed. Washington, DC: American Psychiatric Association; 2013.
- Hilbert A. Binge-eating disorder. *Psychiatr Clin North Am*. 2019;42(1):33–43.
- Pasold TL, McCracken A, Ward-Begnoche WL. Binge eating in obese adolescents: emotional and behavioral characteristics and impact on health-related quality of life. *Clin Child Psychol Psychiatry*. 2014;19(2):299–312.
- Touchette E, Henegar A, Godart NT, Pryor L, Falissard B, Tremblay RE, et al. Subclinical eating disorders and their comorbidity with mood and anxiety disorders in adolescent girls. *Psychiatry Res*. 2011;185(1–2):185–92.
- Gruza RA, Przybeck TR, Cloninger CR. Prevalence and correlates of binge eating disorder in a community sample. *Compr Psychiatry*. 2007;48(2):124–31.
- Abbott DW, de Zwaan M, Mussell MP, Raymond NC, Seim HC, Crow SJ, et al. Onset of binge eating and dieting in overweight women: implications for etiology, associated features and treatment. *J Psychosom Res*. 1998;44(3–4):367–74.
- Striegel-Moore RH, Dohm FA, Kraemer HC, Taylor CB, Daniels S, Crawford PB, et al. Eating disorders in white and black women. *Am J Psychiatry*. 2003;160(7):1326–31.
- Call C, Walsh BT, Attia E. From DSM-IV to DSM-5: changes to eating disorder diagnoses. *Am Psychiatr Curr Opin Psychiatr*. 2013;26(6):532–6.
- Bakalar JL, Shank LM, Vannucci A, Radin RM, Tanofsky-Kraff M. Recent advances in developmental and risk factor research on eating disorders. *Curr Psychiatry Rep*. 2015;17(6):42.
- Polivy J, 1993 Herman CP. Etiology of binge eating: Psychological mechanisms. In: C. G. Fairburn & G. T. Wilson (Eds.) *Binge eating: Nature, assessment, and treatment* (pp. 173–205). Guilford Press. New York
- Brugnera A, Lo Coco G, Salerno L, Sutton R, Gullo S, Compare A, et al. Patients with binge eating disorder and obesity have qualitatively different interpersonal characteristics: results from an interpersonal circumplex study. *Compr Psychiatry*. 2018;1(85):36–41.
- Kober H, Boswell RG. Potential psychological & neural mechanisms in binge eating disorder: implications for treatment. *Clin Psychol Rev*. 2018;1(60):32–44.
- Schulte EM, Grilo CM, Gearhardt AN. Shared and unique mechanisms underlying binge eating disorder and addictive disorders. *Clin Psychol Rev*. 2016;1(44):125–39.
- Safer DL, Jo B. Outcome from a randomized controlled trial of group therapy for binge eating disorder: comparing dialectical behavior therapy adapted for binge eating to an active comparison group therapy. *Behav Ther*. 2010;41(1):106–20.
- Tanofsky-Kraff M, Goossens L, Eddy KT, Ringham R, Goldschmidt A, Yanovski SZ, et al. A multisite investigation of binge eating behaviors in children and adolescents. *J Consult Clin Psychol*. 2007;75(6):901–13.
- Wilkinson PO. Dialectical behavior therapy—a highly effective treatment for some adolescents who self-harm. *JAMA Psychiatry*. 2018;75(8):786–7.
- Schneider E, Higgs S, Dourish C.T. Lisdexamfetamine and binge-eating disorder: A systematic review and meta-analysis of the preclinical and clinical data with a focus on mechanism of drug action in treating the disorder. *Eur Neuropsychopharmacol*. 2021;53((Schneider, Higgs) School of Psychology, University of Birmingham, Edgbaston, Birmingham B15 2TT, United Kingdom):49–78.
- Marcus MD, Kalarchian MA. Binge eating in children and adolescents. *Int J Eat Disord*. 2003;34:S47–57.
- Tanofsky-Kraff M, Yanovski SZ, Yanovski JA. Loss of control over eating in children and adolescents. Developing an evidence-based classification of eating disorders: Scientific findings for DSM-5. 2011; 221–36.
- Goldschmidt AB, Jones M, Manwaring JL, Luce KH, Osborne MI, Cunnings D, et al. The clinical significance of loss of control over eating in overweight adolescents. *Int J Eat Disord*. 2008;41(2):153–8.
- Schluter N, Schmidt R, Kittel R, Tetzlaff A, Hilbert A. Loss of control eating in adolescents from the community. *Int J Eating Disord*. 2016;49(4):413–20.
- Bray B, Sadowski A, Bray C, Bradley R, Zwickley H. Clinical aspects of binge eating disorder: a cross-sectional mixed-methods study of binge eating disorder experts' perspectives. *Front Psychiatry*. 2022;13:1087165.
- Bombak A. Obesity, health at every size, and public health policy. *Am J Public Health*. 2014;104(2):e60–67.
- Robison J. Health at every size: toward a new paradigm of weight and health. *MedGenMed*. 2005;7(3):13.
- Peters MDJ, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. *Int J Evid Based Healthc*. 2015;13(3):141–6.
- Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA extension for scoping reviews (PRISMA-ScR): checklist and explanation. *Ann Intern Med*. 2018;169(7):467–73.
- Pollock D, Peters MDJ, Khalil H, McInerney P, Alexander L, Tricco AC, et al. Recommendations for the extraction, analysis, and presentation of results in scoping reviews. *JBMEvid Synth*. 2023;21(3):520–32.
- Peters MDJ, Marnie C, Tricco AC, Pollock D, Munn Z, Alexander L, et al. Updated methodological guidance for the conduct of scoping reviews. *JBMEvid Synth*. 2020;18(10):2119–26.
- Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71.
- Le Grange D. The maudslay family-based treatment for adolescent anorexia nervosa. *World Psychiatry*. 2005;4(3):142–6.
- Guerdjikova A, Blom T, Mori N, Matthews A, Cummings T, Casuto L, et al. Lisdexamfetamine in pediatric binge eating disorder: a retrospective chart review. *Clin Neuropharmacol*. 2019;42(6):214–6.
- Jones M. Reducing binge eating and overweight in adolescents via the Internet. *Diss Abstr Int: Sect B: Sci Eng*. 2010;71(3-B):2050.
- Hilbert A. Cognitive-behavioral therapy for binge eating disorder in adolescents: study protocol for a randomized controlled trial. *Trials*. 2013;14:312.
- Rasouli Saravi S, Hassani F, Keshavarzi Arshadi F, Farzad V, Sepahmansour M. Effectiveness of group schema therapy on eating attitude and self-regulation in overweight adolescent females with binge eating disorder. *Avicenna J Neuro Psycho Physiol*. 2020;7(1):20–8.

40. Tanofsky-Kraff M, Shomaker L, Wilfley D, Young J, Sbrocchio T, Stephens M, et al. Targeted prevention of excess weight gain and eating disorders in high-risk adolescent girls: a randomized controlled trial. *Am J Clin Nutr*. 2014;100(4):1010–8.
41. Tanofsky-Kraff M, Crosby R, Vannucci A, Kozlosky M, Shomaker L, Brady S, et al. Effect of adapted interpersonal psychotherapy versus health education on mood and eating in the laboratory among adolescent girls with loss of control eating. *Int J Eat Disord*. 2016;49(5):490–8.
42. Shomaker L, Tanofsky-Kraff M, Matherne C, Mehari R, Olsen C, Marwitz S, et al. A randomized, comparative pilot trial of family-based interpersonal psychotherapy for reducing psychosocial symptoms, disordered-eating, and excess weight gain in at-risk preadolescents with loss-of-control-eating. *Int J Eat Disord*. 2017;50(9):1084–94.
43. Mazzeo S, Lydecker J, Harney M, Palmberg A, Kelly N, Gow R, et al. Development and preliminary effectiveness of an innovative treatment for binge eating in racially diverse adolescent girls. *Eat Behav*. 2016;22:199–205.
44. Mehlenbeck RS, Jelalian E, Lloyd-Richardson EE, Hart CN. Effects of behavioral weight control intervention on binge eating symptoms among overweight adolescents. *Psychol Sch*. 2009;46(8):776–86.
45. Fairburn CG. *Overcoming Binge Eating*. New York: Guilford Press; 1995.
46. Gormally J, Black S, Daston S, Rardin D. The assessment of binge eating severity among obese persons. *Addict Behav*. 1982;7(1):47–55.
47. Mazzeo SE, Kelly NR, Stern M, Palmberg AA, Belgrave FZ, Tanofsky-Kraff M, et al. LIBER8 design and methods: an integrative intervention for loss of control eating among African American and white adolescent girls. *Contemp Clin Trials*. 2013;34(1):174–85.
48. Tanofsky-Kraff M, Theim KR, Yanovski SZ, Bassett AM, Burns NP, Ranzenhofer LM, et al. Validation of the emotional eating scale adapted for use in children and adolescents (EES-C). *Int J Eat Disord*. 2007;40(3):232–40.
49. Kamody RC, Thurston IB, Pluhar EI, Han JC, Burton ET. Implementing a condensed dialectical behavior therapy skills group for binge-eating behaviors in adolescents. *Eat Weight Disord*. 2019;24(2):367–72.
50. Hilbert A, Petroff D, Neuhaus P, Schmidt R. Cognitive-behavioral therapy for adolescents with an age-adapted diagnosis of binge-eating disorder: a randomized clinical trial. *Psychother Psychosom*. 2020;89(1):51–3.
51. Dietz LJ, Mufson L, Irvine H, Brent DA. Family-based interpersonal psychotherapy for depressed preadolescents: an open-treatment trial. *Early Interv Psychiatry*. 2008;2(3):154–61.
52. Czaja J, Hartmann AS, Rief W, Hilbert A. Mealtime family interactions in home environments of children with loss of control eating. *Appetite*. 2011;56(3):587–93.
53. Baudinet J, Simic M, Eisler I. From treatment models to manuals: maudsley single-and multi-family therapy for adolescent eating disorders. In: *Handbook of systemic approaches to psychotherapy manuals: integrating research, practice, and training*. Berlin, Heidelberg: Springer; 2022. p. 349–72.
54. Blessitt E, Baudinet J, Simic M, Eisler I. Eating disorders in children adolescents and young adults. In: *The handbook of systemic family therapy*. Hoboken: Wiley; 2020. p. 397–427. <https://doi.org/10.1002/978119438519.ch49>.
55. Chan SM. Early adolescent depressive mood: direct and indirect effects of attributional styles and coping. *Child Psychiatry Hum Dev*. 2012;43(3):455–70.
56. Onder A, Adanir AS. Methylphenidate treatment for binge-eating disorder in a 12-year-old boy. *Psychiatry Clin Psychopharmacol*. 2018;28(2):222–3.
57. Srivastava G, O'Hara V, Browne N. Use of lisdexamfetamine to treat obesity in an adolescent with severe obesity and binge eating. *Children (Basel)*. 2019;6(2):22.
58. NICE. Lisdexamfetamine mesilate [Internet]. 2023 [cited 2023 May 26]. Available from: <https://bnf.nice.org.uk/drugs/lisdexamfetamine-mesilate/>
59. Egbert AH, Wilfley DE, Eddy KT, Boutelle KN, Zucker N, Peterson CB, et al. Attention-deficit/hyperactivity disorder symptoms are associated with overeating with and without loss of control in youth with overweight/obesity. *Child Obes*. 2018;14(1):50–7.
60. Ziobrowski H, Brewerton TD, Duncan AE. Associations between ADHD and eating disorders in relation to comorbid psychiatric disorders in a nationally representative sample. *Psychiatry Res*. 2018;1(260):53–9.
61. Brownley KA, Berkman ND, Peat CM, Lohr KN, Cullen KE, Bann CM, et al. Binge-eating disorder in adults. *Ann Intern Med*. 2016;165(6):409–20.
62. Salvia MG, Ritholz MD, Craigen KLE, Quatromoni PA. Managing type 2 diabetes or prediabetes and binge eating disorder: a qualitative study of patients' perceptions and lived experiences. *J Eat Disord*. 2022;10(1):148.
63. Moustafa AF, Quigley KM, Wadden TA, Berkowitz RI, Chao AM. A systematic review of binge eating, loss of control eating, and weight loss in children and adolescents. *Obesity (Silver Spring)*. 2021;29(8):1259–71.
64. Schueler J, Fields S. Cochrane Central Register of Controlled Trials. 2023 [cited 2023 May 25]. Comparison of a Telehealth Versus In-person Intervention for Binge Eating. Available from: <https://clinicaltrials.gov/show/NCT05725408>
65. Goldschmidt AB, Lavender JM, Hipwell AE, Stepp SD, Keenan K. Emotion regulation and loss of control eating in community-based adolescents. *J Abnorm Child Psychol*. 2017;45(1):183–91.

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