Randomised controlled trial of a guided self-help treatment on the Internet for binge eating disorder

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ABSTRACT

Binge eating disorder (BED) is a common and under-treated condition with major health implications. Cognitive behavioural therapy (CBT) self-help manuals have proved to be efficient in BED treatment. Increasing evidence also support the use of new technology to improve treatment access and dissemination. This is the first randomised controlled study to evaluate the efficacy of an Internet guided self-help treatment programme, based on CBT, for adults with threshold and subthreshold BED. Seventy-four women were randomised into two groups. The first group received the six-month online programme with a six-month follow-up. The second group was placed in a six-month waiting list before participating in the six-month intervention. Guidance consisted of a regular e-mail contact with a coach during the whole intervention. Binge eating behaviour, drive for thinness, body dissatisfaction and interoceptive awareness significantly improved after the Internet self-help treatment intervention. The number of objective binge episodes, overall eating disorder symptoms score and perceived hunger also decreased. Improvements were maintained at six-month follow-up. Dropouts exhibited more shape concern and a higher drive for thinness. Overall, a transfer of CBT-based self-help techniques to the Internet was well accepted by patients, and showed positive results for eating disorders psychopathology.

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Introduction

Binge eating disorder (BED) is characterised by recurrent episodes of binge eating with a sense of loss of control and a marked distress, without the inappropriate compensatory behaviour observed in bulimia nervosa. BED appears to be a stable condition, more common than bulimia nervosa or anorexia nervosa (Hudson, Hiripi, Pope, & Kessler, 2007), with a raising prevalence. For instance, community surveys conducted in South Australia inferred an over twofold increase in the prevalence of binge eating between 1995 and 2005 (Hay, Mond, Buttner, & Darby, 2008).

BED represents a serious public health problem (Hudson et al., 2007). It is often associated with obesity, psychological impairment and a lower quality of life (Grucza, Przybeck, & Cloninger,

2007). A recent study found that 70% of individuals with BED in a community sample were also obese, with 20% of people reporting a body mass index (BMI; weight in kg/height in m^2) over 40 (Grucza et al., 2007). BED frequently occurs with mood and anxiety disorders, substance use disorders and a life history of suicide attempts. Studies showed that up to 74% of BED individuals reported additional lifetime psychiatric disorders (Grilo, White, & Masheb, 2009; Grucza et al., 2007; Javaras et al., 2008; Wilfley, Wilson, & Agras, 2003).

BED and associated psychopathology can be effectively treated by cognitive behavioural therapy (CBT; Wilfley et al., 2002; Wilson, Wilfley, Agras, & Bryson, 2010). CBT for BED was also evaluated in self-help format, with results comparable to individual CBT or group therapy (Carter & Fairburn, 1998; Grilo & Masheb, 2005). In a recent meta-analysis, CBT delivered in structured self-help was observed to have larger effects on the reduction of binge eating frequency and associated symptoms, such as eating, weight and shape concerns compared to available psychological, pharmacological and weight-loss treatments for BED (Vocks et al., 2010). But it has also been repeatedly demonstrated that CBT had no effect on weight reduction even if most of the studies participants were

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obese (Vocks et al., 2010). Acceptance and efficacy of CBT-based guided self-help were also demonstrated in a primary care context, using a broader definition of eating disorders (Striegel-Moore et al., 2010). This study provided new findings in favour of the use of guided self-help as first line treatment, with a more adequate replication of the conditions found in clinical practice.

BED sufferers experience a limited access to treatment. The problem is under-treated and often not diagnosed. This might be due to a lack of information, and shame or denial on the part of the patients. Less than half of BED patients seek treatment for their eating disorder and BED is rarely screened by physicians (Crow, Peterson, Levine, Thuras, & Mitchell, 2004). Developing innovative treatment strategies, particularly using the latest information technology, could help promote treatment seeking and improve access to treatment (Bulik, Brownley, & Shapiro, 2007).

The benefits of delivering CBT-based intervention on CD-ROM or through the Internet have been demonstrated in several studies for bulimia nervosa. Clinical evaluations of an online-guided self-help programme for bulimia nervosa, conducted in four countries as part of the European research project SALUT, showed reduction of eating disorder symptoms and psychopathology from all four countries (Carrard et al., 2010, 2006; Fernandez-Aranda et al., 2009; Liwowsky, Cebulla, & Fichter, 2006; Nevonen, Mark, Levin, Lindstrom, & Paulson-Karlsson, 2006). A randomised controlled study of a three-month CD-ROM for bulimia nervosa suggested that providing guidance might increase adherence and benefits of computerised interventions (Schmidt et al., 2008). A subsequent randomised controlled trial within a student population of an Internet version of this CD-ROM, delivered with e-mail support, produced significant improvements on eating disorders psychopathology, affective symptoms and quality of life compared to a three-month waiting list (Sanchez-Ortiz et al., 2010).

Until recently, little has been done on technology-enhanced delivery of CBT-based interventions for BED. To our knowledge, only one study evaluated the use of a CD-ROM programme for BED and overweight patients. A randomised controlled trial comparing the efficacy of a ten-week CD-ROM intervention, a CBT group and a waiting list had comparable reduction in binge days between CBT group and CD-ROM, both interventions showing better results than a waiting list (Shapiro et al., 2007). However, conclusions of this study were limited by a high rate of dropout. Online programmes have mainly targeted weight loss or weight maintenance in overweight or obese patients (Tate, Jackvony, & Wing, 2006; Tate, Wing, & Winett, 2001) but BED, which is an eating disorder frequently found in people looking for weight loss (Spitzer et al., 1993), was not a direct focus. Only a single recent randomised controlled study evaluated an Internet intervention addressing binge eating and overweight in adolescents (Jones et al., 2008). This 16-week Internet programme, combining cognitive-behavioural principles for BED and weight loss intervention, had a significant effect on binge eating and weight maintenance simultaneously.

This paper reports the results of a randomised controlled study to evaluate the efficacy of an Internet guided self-help treatment programme for BED in a community sample. The programme is based on CBT, and targets behavioural and psychological aspects of BED such as loss of control on eating and shape and weight concerns. Obesity, weight loss and weight management were not addressed directly in the programme. We hypothesised that key outcome variables related to binge eating and eating disorder psychopathology of the Internet intervention group would improve compared to a control group, and that the Internet self-help treatment programme would have positive effects on depression, psychological health, self-esteem and quality of life. We also hypothesised that these improvements would be sustained at follow-up.

Method

Participants and recruitment

Recruitment started in 2008 and was done directly in the community through articles in a women's magazine and in pharmacy and physicians' newspapers. Links to information for the Internet self-help programme were added on two websites related to health. These advertisements proposed to women with compulsive eating to try a new Internet self-help treatment programme designed for BED. Only women were recruited because, in our experience, men appeared to enrol with more difficulties in studies on binge eating and it would not have been possible to balance the samples. Interested people could get information on the study by e-mail. The study protocol was then explained, notably that participants had to come to the University Hospitals of Geneva (Switzerland) for face-to-face evaluation sessions on three occasions during a year.

Participants included were women, between 18 and 60 years old, fluent in French, with average Internet skills and meeting full or subthreshold diagnostic criteria for BED according to DSM-IV (American Psychiatric Association, 1994). The criterion of binge frequency for subthreshold inclusion was at least one objective binge episode (OBE) a week for the last three months. The criterion of one binge episode a week was shown to adequately discriminate subthreshold BED subjects from the control population (Striegel-Moore, Wilson, Wilfley, Elder, & Brownell, 1998). Recent suicide attempt and past obesity surgery were exclusion criteria. Participants on antidepressant medication ($N = 14$) were required to have been stable on medication for a minimum of three months.

Of 160 respondents, eleven did not match the study inclusion criteria. Thirty-nine persons could not or did not want to come for face-to-face evaluation sessions and 24 were finally not interested. Experienced psychologists then interviewed the remaining 86 respondents. Of these, 10 were excluded because they did not meet threshold eating disorder criteria and two because they had had bariatric surgery. A total of 74 participants were randomised into two groups (see CONSORT diagram in Fig. 1).

Procedure and design

The presence of eating disorder was evaluated with the assistance of the EDO (Eating Disorders in Obesity) questionnaire (de Man Lapidoth, Ghaderi, Halvarsson-Edlund, & Norring, 2007). A French version of the questionnaire (Carrard & Crépin, 2007) was obtained after translation, back-translation and main author's approval. The EDO questionnaire is originally a self-report questionnaire based on DSM-IV diagnostic criteria for BED. But in the present study, the EDO was completed together with the assessor, to ensure a good understanding of questions and definitions. This was also a way to guarantee a standardization of the interview.

After the interview, included participants were randomised into one of two conditions:

- Internet Group: Participants assigned to the Internet Group received the Internet intervention immediately after first assessment. They had six months to complete the Internet guided self-help treatment programme and then a six-month follow-up period.
- Control Group: Participants assigned to the Control Group had a six-month waiting period. They received then the Internet self-help treatment for ethical reasons. They had six months to complete the programme.
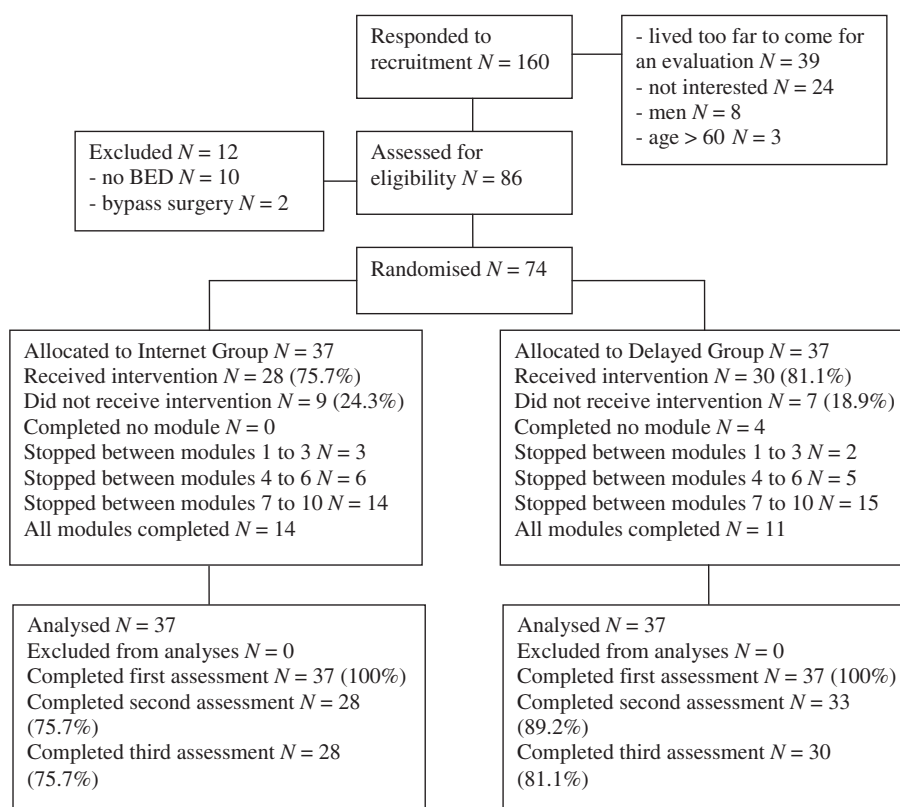
Fig. 1. CONSORT diagram.

Both groups were assessed with self-report questionnaires at baseline, after six months (of Internet programme or waiting list) and after one year (after six months of follow-up or of Internet programme).

Participation in the study was free of charge. Local ethics committee approved the study protocol and written informed consent was obtained from participants.

Randomisation

Assessors allocated participants to treatment groups following a computer-generated randomisation sequence and were thus not blind to treatment allocation, which could bias participants' evaluation. However assessments following the inclusion interview were done by self-report questionnaires only, so assessors did not interfere in the participants' answers. Therefore biases should be limited.

Assessments

Three questionnaires evaluating various aspects of eating disorders were used as outcome measures.

- EDE-Q: *Eating Disorder Examination-Questionnaire* (Fairburn & Beglin, 1994; Mobbs & Van der Linden, 2006), widely used self-report instrument, which comprises four subscales — restraint, eating concern, shape concern and weight concern - and a total score, as well as an evaluation of symptoms frequency. The whole assessment refers to the last 28 days. The use of EDE-Q with BED patients was considered acceptable (Grilo, Masheb, & Wilson, 2001) and test-retest reliability was supported (Reas, Grilo, & Masheb, 2006). In the present study, Cronbach's alphas ranged from .72 to .85 except for eating concern ($\alpha = .65$) and weight concern ($\alpha = .44$), revealing a lack of internal consistency for these two subscales.

- EDI-2: *Eating Disorder Inventory-2* (Archinard, Rouget, Painot, & Liengme, 1994; Garner, Olmsted, & Polivy, 1983), self-report measure which assesses symptoms, attitudes and behaviours associated with eating disorders. It is subdivided into 11 subscales: Drive for thinness, bulimia, body dissatisfaction, ineffectiveness, perfectionism, interpersonal distrust, interoceptive awareness, maturity fears, asceticism, impulse regulation and social insecurity. The EDI-2 was reported to have acceptable internal consistency and test-retest stability for BED patients (Tasca, Illing, Lybanon-Daigle, Bissada, & Balfour, 2003). In the present study, Cronbach's alphas at baseline ranged from .70 to .91 for all subscales, showing an adequate internal consistency, except for asceticism ($\alpha = .45$).

- TFEQ: *Three-Factor Eating Questionnaire* (Lluch, 1995; Stunkard & Messick, 1985), 51-item inventory designed to measure three dimensions: eating restraint, disinhibition which is a tendency towards loss of control on eating, and susceptibility for hunger, referring to perception of hunger and satiety. It was first developed for obesity research and widely used to investigate hypothetical causal links between restraint, eating disorders and obesity. TFEQ validity and reliability were demonstrated (Allison, Kalinsky, & Gorman, 1992) but not consistently (Karlsson, Persson, Sjostrom, & Sullivan, 2000). Internal consistency found in the current sample was good for restriction ($\alpha = .82$) and hunger ($\alpha = .79$), but unacceptable for disinhibition subscale ($\alpha = .24$).

In addition, questionnaires to assess psychological health, depression, self-esteem and quality of life were completed by participants.

- SCL-90R: *Symptom Checklist-90-Revised* (Derogatis, 1977; Guelfi & Dreyfus, 1997), 90-item self-report instrument to assess a broad range of psychopathological symptoms, including depression and anxiety. A total score, called the Global Severity Index (GSI) and representing an indicator of overall psychological distress, can be computed. GSI internal consistency found in this study was good ($\alpha = .96$).
- BDI-II: *Beck Depression Inventory-II* (Beck, Steer, & Brown, 1996), 21-item self-report inventory of depressive symptoms. The total score ranges from 0 to 63, a higher score indicating a more severe condition. Cronbach's alpha in the current study was .85, showing a good internal consistency.
- RSES: *Rosenberg Self-Esteem Scale* (Rosenberg, 1965; Vallières & Vallerand, 1990), 10-item scale with a global score of self-esteem. The higher the score, the better the self-esteem. A cutoff of 20 is considered as the limit of a good self-esteem. A good internal consistency was found in the present sample ($\alpha = .89$).
- IWQOL-Lite: *Impact of Weight on Quality of Life short form* (Kolotkin, Crosby, Kosloski, & Williams, 2001), 31-item self-report questionnaire assessing quality of life related to weight in five domains — physical function, self-esteem, sexual life, public distress and work — plus a total score used in this study. This instrument was chosen because of the common association of BED with overweight and obesity. Scoring in this paper is based on transformed scores ranging from 0 to 100. The higher the score is, the better the quality of life. Cronbach's alpha showed a good internal consistency of the total score in this study ($\alpha = .94$).

The participants also completed questionnaires providing socio-demographics, psychological and medical history, height and weight, as well as, items related to recruitment procedure, interest in the study and user satisfaction with the programme. User participation and programme adherence was measured by other data captured by the programme, that is, number of sent messages, number of connections per participants in the programme (logs), number of programme modules completed and number of days exercises were filled out.

Primary and secondary outcomes

The primary outcome chosen was the EDI-2 bulimia subscale, because this scale was sensitive to participants' progress in previous studies using the Internet programme for bulimia nervosa (Carrard et al., 2010).

Secondary outcomes were eating disorder related variables: EDI-2 subscales, EDE-Q scales and total score as well as number of OBE, the proportion of patients abstinent from bingeing, and TFEQ dimensions. BDI-II score, SCL-90R GSI, IWQOL-Lite total score, RSES score and BMI were included as secondary outcomes as well. The four scales with poor results on reliability (EDE-Q eating and weight concerns, EDI-2 asceticism and TFEQ disinhibition) were not included in the analyses.

Sample size

No formal power analysis was conducted. Based on the effect size (.7) of the EDI-2 bulimia subscale change observed in previous European studies with the Internet programme on bulimia nervosa (Carrard et al., 2010), a sample size of 37 participants per group was estimated sufficient to detect a group difference over time with a power of 80%. A dropout rate of 30% inferred from the previous European studies was also taken into account.

Internet self-help treatment programme

The Internet self-help treatment programme for BED was written and developed in French. The content was based on the previous online programme for bulimia nervosa developed in the SALUT project, with additional updates and modules to address specifically BED. The online programme for BED consisted of 11 modules (see Table 1 for a summary of the modules), inspired by CBT usual techniques for binge eating treatment, exposed for example in the self-help book *Overcoming binge eating* (Fairburn, 1995).

Participants worked through the modules sequentially. Each module contained theory and exercises that participants completed directly in the programme. Self-observation was a key point. A self-monitoring diary was introduced from the second module and was used for the whole duration of the self-help treatment. Automatic feedback, generated by the programme, provided an objective view of frequency and evolution of participants' behaviour.

Guidance

Two psychologists worked as coaches and provided weekly guidance. Participants were randomised to each coach. The central

Table 1
Internet programme modules description.

Modules	Topics	Exercises	Duration
Introduction	What is BED and how the Internet self-help treatment can help you	BMI calculation	Free access
1. Motivation	BED cycle, how BED maintains	Current behaviour advantages/disadvantages. Imagine your life in one year	3 days
2. Daily self-monitoring	What is the point of self-monitoring	Introduction to diary and diary feedback	2 weeks
3. Binge triggers	Triggers related to food/emotions Pleasure derived from eating	Note down triggers and pleasure derived from eating in the diary Audio: mindfulness raisin exercise	2 weeks
4. Meal plans	Why eat regularly Introduction to food pyramid	Meal schedule Forbidden food exposure	2 weeks
5. Strategies	Find behavioural strategies to prevent binge eating	Note down strategies in the diary Audio: relaxation	2 weeks
6. Physical activity	Try new activity breaks in your daily life	Note down activity breaks in the diary	2 weeks
7. Problem solving	Find out more complex strategies to prevent binges	Problem solving in six steps	2 weeks
8. Assertiveness	Express your needs	Make and refuse a request Make and receive a critique	2 weeks
9. Automatic thoughts	What is your internal speech?	Write down your automatic thought and rate related moods	2 weeks
10. Cognitive restructuring	Consider things with a wider angle	Write down alternative thoughts and rerate moods	2 weeks
11. Relapse prevention	Review of the techniques When use them	Links to previous modules	1 day

role of the coaches was to provide support and answer questions. Coaches could monitor participants' progress and review completed exercises, diary entry, and automatic feedback charts, to ensure a correct use of the techniques.

During the Internet intervention phase, participants and coaches maintained weekly e-mail contact. Monthly e-mail contact was maintained during follow-up or waiting periods. If participants did not enter the programme or did not write any e-mail for two weeks, their coach called them on the phone to reinforce their motivation. After four weeks without any connection, the participants' programme access was cancelled and participants were considered as study dropouts.

Confidentiality

Thorough attention was given to confidentiality and data protection. Participants received a pseudonym and a password to access the online programme. For security reasons, they had to change their password at first connection. All personal information on patients was stored separately in the institution. An integrated messaging system enabled secured message exchange between coaches and participants. E-mail addresses were protected by one-way encryption. The website met Health on the Net (HON) quality and ethics standards (www.hon.ch).

Statistical analyses

Data were analysed with SPSS for Windows, version 17.0, 2008 (SPSS Inc, Chicago, IL).

Completers were defined as participants who completed all three assessments. Dropouts were those who only completed one or two assessments. Analyses were performed for all randomised patients (Intention-To-Treat (ITT)) analyses. Missing data were imputed with the maximum likelihood EM algorithm. Results obtained with ITT analyses were compared with analyses on completers. If a difference occurred, it was reported in the results section.

To evaluate differences between the two randomised groups at baseline, comparisons were calculated with independent samples *t*-tests and Pearson's chi-squares for categorical variables. The same procedure was performed to compare completers and dropouts.

To evaluate the efficacy of the Internet self-help treatment programme, data collected at baseline and at second assessment (before and after six months of Internet programme or waiting list) were used. Linear mixed models with random intercept were run with three fixed factors introduced in the analyses: group, time and intervention. This way, the intervention factor captured the effects due to the Internet intervention in comparison with a waiting list, after removal of any confounding effects of group and time differences not due to the intervention.

As secondary analyses, linear mixed models with random intercept and with time as fixed factor were used to evaluate the sustainability between second and third assessments of the intervention effects found in the Internet Group. Moreover, similar analyses were conducted on pre- post-intervention data collected in the Control Group (second and third assessments), to substantiate the results found in the Internet Group. All significant results reported were corrected with Bonferroni method to account for multiple testing.

Percentages of participants "abstinent" from bingeing were calculated in each group. Abstinence for the study was defined as zero OBE for the past 28 days as measured by the EDE-Q. Percentages were compared between groups with Pearson's chi-squares.

Results

Baseline characteristics

The sample was characterised by a mean age of 36 years old ($SD = 11.4$, range 21–60) and a mean BMI of 28.8 ($SD = 5.7$, range 19.5–42.5). Fifty-eight percent ($N = 43$) met full BED diagnostic criteria. Proportions of full or subthreshold diagnoses were equally distributed between both randomised groups. Only 13.5% ($N = 10$) had a history of treatment for their eating disorder. More than half of the sample (55.4%) reported a past or present comorbid depression episode. Demographic data for both groups are displayed in Table 2. No differences emerged between groups on demographic characteristics. Only EDI-2 body dissatisfaction means were different between the Internet Group and the Control Group ($t(72) = 2.4$, $p = .021$) when baseline values of all outcome variables (Table 3) were compared.

Thirty-one participants (41.9%) found out about the study through newspapers articles, 30 (40.5%) through the Internet and 13 (17.6%) through other means (friends and caregivers).

Completion rate

Thirteen participants (17.6%) dropped out between first and second assessment and three (4.0%) more between second and third assessment, resulting in a final rate of 78.4% of completion ($N = 58$). A total of twelve participants (16.2%) dropped out during

Table 2
Demographic characteristics by group (mean and standard deviation (*SD*)).

	Internet group N = 37		Control group N = 37	
	Mean	SD	Mean	SD
Age	34.4	11.0	37.8	11.8
BMI	29.8	5.9	27.7	5.5
	N	%	N	%
Binge eating disorder				
Full syndrome	20	54.1	23	62.2
Subthreshold	17	45.9	14	37.8
Educational level				
Compulsory school	2	5.4	1	2.7
Professional school	17	45.9	18	48.6
University	18	48.6	18	48.6
Marital status				
Single	14	37.8	14	37.8
Married-living together	20	54.0	20	54.0
Divorced-separated	2	5.4	3	8.1
Widowed	1	2.7	0	0
Professional status				
Employed (full or part time)	25	67.5	31	83.8
Student	3	8.1	2	5.4
Unemployed	3	8.1	0	0
At home	2	5.4	2	5.4
Other	4	10.8	2	5.4
Found about the study				
Newspaper	13	35.1	18	48.6
Internet	14	37.8	16	43.2
Other	10	27.0	3	8.1
ED treatment history				
Past	7	18.9	3	8.1
None	30	81.1	34	91.9
Other psychopathological condition				
No	15	40.5	18	48.6
Yes	22	59.5	19	51.4

Note. BMI Body Mass Index; ED Eating Disorder.

Table 3
Means and standard deviations (SD) of the Internet (N = 37) and Control (N = 37) groups at baseline, 6 months and 1 year assessments.

	Baseline				6 months assessment				1 year assessment			
	Internet group		Control group		Internet group		Control group		Internet group		Control group	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Eating Disorder Inventory-2												
Drive for thinness	11.5	4.9	11.6	5.2	8.9	5.9	11.0	4.9	5.4	4.7	7.8	6.0
Bulimia	6.3	3.4	6.5	4.1	2.8	2.6	5.9	4.4	1.7	1.9	2.5	2.9
Body dissatisfaction	22.3	5.2	19.0	6.7	19.0	7.0	18.9	6.8	15.6	7.7	14.5	9.2
Ineffectiveness	5.4	6.6	6.8	6.5	3.7	3.5	5.6	6.1	2.3	2.8	3.8	5.1
Perfectionism	6.5	4.3	6.6	4.5	6.5	4.3	5.8	4.5	5.1	3.8	5.4	4.1
Interpersonal distrust	3.8	3.9	4.5	4.0	3.0	3.4	3.8	3.3	2.3	3.1	3.0	3.6
Interoceptive awareness	7.0	5.3	7.4	5.5	4.5	4.5	7.3	6.2	3.2	3.5	4.1	4.2
Maturity fears	3.4	4.1	2.6	2.7	2.3	2.6	2.2	2.8	2.3	2.5	2.1	2.9
Impulse regulation	4.0	3.9	3.8	5.1	2.7	2.6	3.8	4.3	1.8	2.4	2.4	2.8
Social insecurity	5.4	3.4	5.2	4.2	3.6	2.6	4.7	3.9	2.9	2.3	3.7	3.6
EDE-Q												
Objective binge episodes	17.4	15.6	14.8	9.6	5.5	7.4	9.1	8.8	5.5	7.9	5.2	5.5
Restraint	2.3	1.5	1.8	1.3	1.7	1.4	1.8	1.3	1.3	1.1	1.2	1.3
Shape concern	4.7	.9	4.3	1.1	3.7	1.3	4.1	1.3	2.9	1.5	3.3	1.9
Total	3.6	.8	3.3	1.0	2.5	1.1	2.9	1.0	1.9	1.1	2.3	1.5
Other outcomes												
TFEQ restraint	9.1	4.7	8.3	4.0	8.5	3.9	8.3	3.8	7.5	4.1	7.6	3.8
TFEQ hunger	8.7	3.7	8.9	3.2	6.7	2.9	9.3	2.8	5.1	3.4	6.7	3.5
BDI-II	15.3	9.7	16.8	10.2	10.0	7.4	13.2	9.6	7.7	5.9	10.6	8.3
SCL-90R GSI	.8	.4	.9	.6	.6	.4	.8	.5	.4	.3	.5	.3
RSES	17.5	5.2	18.1	5.9	21.3	4.2	19.1	4.9	22.5	4.1	21.0	5.4
IWQOL-Lite total score	66.9	15.3	71.6	16.3	71.7	16.7	71.8	18.0	78.2	14.8	76.0	20.2
BMI	29.8	5.9	27.7	5.5	29.2	6.0	27.9	5.4	29.0	6.3	27.6	5.5

Note. BDI-II Beck Depression Inventory-II; BMI Body Mass Index; EDE-Q Eating Disorder Examination-Questionnaire; IWQOL-Lite Impact of Weight on Quality of Life short form; RSES Rosenberg Self-Esteem Scale; SCL-90R GSI Global Severity Index Symptom Check-List-90 Revised; TFEQ Three-Factor Eating Questionnaire.

the online self-help treatment intervention phase of both groups. Dropouts were not associated with any particular modules of the Internet programme. Four participants (5.4%) in the Control Group dropped out during the waiting period. No participants in the Internet Group dropped out during follow-up.

Baseline differences between dropouts and completers were investigated. Independent samples *t*-tests showed that dropouts had more concerns about shape than completers (EDE-Q shape concern: $M = 4.9$ ($SD = .7$) vs $M = 4.4$ ($SD = 1.0$), $t(72) = -2.5$, $p = .018$). A difference of EDI-2 drive for thinness was also observed ($M = 14.4$ ($SD = 3.8$) vs $M = 10.7$ ($SD = 5.0$), $t(72) = -2.7$, $p = .008$). Demographic characteristics and other outcome variables of both groups were similar at baseline.

Treatment outcome: intervention effect for eating disorder features

Results of the linear mixed models for eating disorder questionnaires are reported in Table 4. ITT analyses of the effect of intervention on participants in the Internet Group in comparison with wait-listed participants in the Control Group showed significant differences. The primary outcome variable as measured by the EDI-2 bulimia subscale decreased significantly after intervention. Secondary outcome variables, such as EDI-2 drive for thinness, body dissatisfaction and interoceptive awareness scores, EDE-Q total score, shape concern and number of OBE, as well as TFEQ hunger score, also improved significantly. As a comparison, analyses run on completers' data also showed an improvement for EDI-2 impulse regulation subscale ($F(1,59.8) = 4.3$, $p = .044$).

Abstinence rate

Pearson's chi-squares were used to compare percentages of abstinence rates in both groups. ITT analyses showed a significant difference ($\chi^2(1) = 8.0$; $p = .005$) in the abstinence rate of the Internet Group after six-month self-help intervention (35.1%;

$N = 13$) compared to the abstinence rate of the Control Group after six-month waiting list (8.1%; $N = 3$).

After six months of self-help intervention, the abstinence rate of the Control Group reached 21.6% ($N = 8$). A chi-square analysis showed that the difference in abstinence rate of both groups after the six-month intervention was not significant ($\chi^2(1) = 1.7$; $p = .197$).

At six-month follow-up, the abstinence rate of the Internet Group reached 43.2% ($N = 16$).

Intervention effect for psychological health, self-esteem, quality of life and BMI

ITT analyses run with linear mixed models showed an intervention effect for self-esteem, as assessed by the RSES total score and for quality of life, as assessed by IWQOL-Lite total score (Table 4). The BMI of participants also improved with the Internet programme in comparison with waiting list. No intervention effect was found for BDI-II total score and SCL-90R GSI.

Secondary analyses

Linear mixed models were performed to analyse the sustainability of intervention effects in the Internet Group. At six-month follow up, improvements were sustained in the EDI-2 subscales of bulimia ($F(1,36) = 6.1$, *ns*), interoceptive awareness ($F(1,36) = 4.6$, *ns*), EDE-Q total score ($F(1,36) = 9.1$, *ns*) and self-esteem ($F(1,36) = 6.2$, *ns*). The reduction of OBE ($F(1,36) = .0$, *ns*) and the decline in BMI ($F(1,36) = .4$, *ns*) were also maintained. Further improvements were observed for EDI-2 subscales of drive for thinness ($F(1,36) = 19.3$, $p < .001$) and body dissatisfaction ($F(1,36) = 13.4$, $p = .001$), EDE-Q shape concern ($F(1,36) = 12.3$, $p = .001$), TFEQ hunger score ($F(1,36) = 11.0$, $p = .002$) and IWQOL-Lite total score ($F(1,36) = 15.6$, $p < .001$).

Linear mixed models were run to explore the effect of the Internet programme in the Control Group. The primary outcome

Table 4
Results of linear mixed model analyses, differences between both groups at six-month assessment (intention-to-treat analyses).

Outcome	Main effet of intervention			Main effect of group			Main effect of time		
	F	dl	p value	F	dl	p value	F	dl	p value
Eating Disorder Inventory-2									
Drive for thinness	5.7	1,72	.020	.0	1,90.7	.912	.9	1,72	.355
Bulimia	16.3	1,72	<.001	.0	1,103.8	.851	.9	1,72	.335
Body dissatisfaction	12.4	1,72	.001	4.8	1,86.9	.031	.0	1,72	.922
Ineffectiveness	.2	1,72	.646	1.0	1,106.5	.312	1.8	1,72	.183
Perfectionism	1.1	1,72	.305	.0	1,91.5	.979	2.7	1,72	.107
Interpersonal distrust	.0	1,72	.956	.9	1,97.1	.358	2.4	1,72	.125
Interoceptive awareness	5.3	1,72	.024	.1	1,102.8	.782	.0	1,72	.953
Maturity fears	1.0	1,72	.329	1.0	1,107.0	.315	.7	1,72	.409
Impulse regulation	2.8	1,72	.099	.1	1,99.7	.819	.0	1,72	1.000
Social insecurity	.4	1,72	.518	.7	1,100.7	.419	.9	1,72	.337
EDE-Q									
Objective binge episodes	4.8	1.72	.031	1.1	1,127.2	.299	8.0	1,72	.006
Restraint	3.6	1.72	.063	2.8	1,118.9	.097	.0	1,72	.980
Shape concern	11.6	1.72	.001	2.7	1,99.9	.104	2.0	1,72	.157
Total	14.5	1.72	<.001	1.5	1,99.4	.225	6.8	1,72	.011
Other outcomes									
TFEQ restraint	.5	1.72	.500	.6	1,97.8	.429	.0	1,72	.973
TFEQ hunger	12.6	1.72	.001	.1	1,107.6	.743	.7	1,72	.419
BDI-II	.7	1.72	.405	.5	1,109.6	.476	6.4	1,72	.013
SCL-90R GSI	.0	1.72	.880	1.4	1,96.5	.239	4.4	1,72	.039
RSES	6.2	1.72	.015	.2	1,110.2	.648	1.6	1,72	.209
IWQOL-Lite total score	4.3	1.72	.041	1.5	1,84.2	.231	.0	1,72	.860
BMI	10.4	1.72	.002	2.4	1,73.1	.126	1.3	1,72	.264

Note. BDI-II Beck Depression Inventory-II; BMI Body Mass Index; EDE-Q Eating Disorder Examination-Questionnaire; IWQOL-Lite Impact of Weight on Quality of Life short form; RSES Rosenberg Self-Esteem Scale; SCL-90R GSI Global Severity Index Symptom Check-List-90 Revised; TFEQ Three-Factor Eating Questionnaire.

variable as measured by the EDI-2 bulimia subscale decreased significantly ($F(1,36) = 18.7, p < .001$). Secondary outcomes in eating disorders questionnaires also improved, such as EDI-2 subscales drive for thinness ($F(1,36) = 22.1, p < .001$), body dissatisfaction ($F(1,36) = 19.6, p < .001$), ineffectiveness ($F(1,36) = 13.6, p = .001$) and interoceptive awareness ($F(1,36) = 12.2, p = .001$). EDE-Q shape concern ($F(1,36) = 14.9, p < .001$) and total score ($F(1,36) = 17.8, p < .001$) and TFEQ hunger ($F(1,36) = 35.1, p < .001$) decreased as well. Among other outcomes, SCL-90R GSI decreased significantly ($F(1,36) = 27.6, p < .001$).

Adherence

Number of modules completed, messages sent, logs in the programme and number of days completed in the diary were used as indicators of adherence. Among the 74 participants in the study, 25 (33.8%) completed all 11 modules of the Internet programme. Fifty-four (73%) participants reached module 6. Participants logged on 81.1 times on average in the Internet programme ($SD = 51.8$, range 1—191). Most frequent hours of connection were between 8:00 pm and 11:00 pm. The number of days completed in the diary ranged from 0 to 214 days, with a mean of 96.3 days ($SD = 61.4$). Participants sent between 1 and 47 messages to their coach ($M = 21.8, SD = 10.9$).

Discussion

This study investigated the efficacy of an Internet CBT-based self-help treatment programme for BED. Participants were randomised into two groups. The Internet Group started with a six-month period of intervention, and then continued with a six-month follow-up. The Control Group waited for six months before receiving the Internet intervention for six months.

Many participants (40.5%) found the study through the Internet when searching for information with keyword such as BED or treatment. Ease of first contact is valuable for BED sufferers, who experience shame and lack of information about their disorder. Online delivery of self-help treatment brings additional visibility and facilitates access. Both are definite advantages for an under-treated condition such as BED.

Efficacy on eating disorder symptoms

In accordance with our hypotheses, the six-month Internet self-help treatment programme had a positive effect on symptoms associated with eating disorders in comparison with a waiting list. The primary outcome variable, EDI-2 bulimia subscale, displayed the most significant effect after the Internet intervention. This scale is particularly relevant because it measures dysfunctional behaviour typical to BED, such as eating while being upset, binge eating or thinking about bingeing, eating moderately in social settings, then bingeing afterwards.

Secondary outcome variables also showed marked improvement. The number of OBE per month reduced significantly and EDE-Q total score, including shape concern, also decreased. TFEQ hunger and EDI-2 interoceptive awareness, both related to internal sensations such as hunger and satiety, improved. Drive for thinness and body dissatisfaction decreased, giving perhaps some indications that participants were more able to put shape and weight concerns into perspective after the intervention. Finally, percentages of abstinence from bingeing after six months of Internet programme varied in both groups between 22% and 35% in ITT analyses.

Efficacy on comorbid characteristics

Among variables assessing comorbid characteristics, self-esteem was significantly improved. These results could be a consequence of better control of eating behaviour. It could also be due to a decrease in body dissatisfaction. Self-esteem in BED psychopathology seems to be related to shape and weight concerns and body dissatisfaction, however its role as a cause or consequence requires further research (Dunkley & Grilo, 2007).

Quality of life, as measured by the IWQOL-Lite total score, was also significantly improved. This improvement may be related to the decline observed in BMI in the Internet Group, since the IWQOL-Lite questionnaire addresses quality of life related to excess weight.

Contrary to self-esteem and quality of life, depression and psychological health did not show significant improvement. This is consistent with a recent meta-analysis on the effectiveness of psychological treatment for BED showing only marginal effects on depressive symptoms of CBT interventions for BED, which the authors attributed to treatment techniques that were not specifically targeted to negative affect (Vocks et al., 2010).

Finally, BMI slightly decreased with intervention. This effect was not expected since the programme did not focus on weight loss. Moreover, until now, no psychological approach has demonstrated a consistent influence on weight loss (Vocks et al., 2010). As underlined by a recent study, a long-term perspective should always be taken before claiming that a psychological treatment has any effect on weight loss (Cooper et al., 2010).

Secondary analyses

All gains were sustained or continued to improve at six-month follow-up in the Internet Group. Abstinence rate from bingeing among participants reached 43%. Participants still had access to the Internet programme during the six-month follow-up period. We can infer that they continued applying the principles of the programme.

Overall similar improvements to those observed in the Internet Group were observed on eating disorder questionnaires after the Internet programme when it was delivered to the Control Group. Moreover, EDI-2 ineffectiveness subscale and SCL-90R global score also improved, showing a better feeling of control over life and a better psychological health after the Internet programme. However these results were not obtained in comparison with a control group and thus have to be taken with caution. Contrary to the results found in the Internet Group which received the intervention immediately, frequency of OBE, self-esteem, quality of life and BMI did not improved with intervention in the Control Group. OBE frequency was already reduced in the Control Group after the waiting period. The frequency of OBE reached by the Control Group after intervention is similar to that reached by the Internet Group. Regarding self-esteem, scores were already in a normal range when participants started the intervention, reducing the possibility of improvement. Finally, the absence of reduction in BMI after intervention in the Control Group questions about the effect of the Internet programme on weight loss. It can also explain that quality of life related to excess weight did not change in this group after the Internet intervention. In retrospect, another quality of life questionnaire devised more particularly for eating disorders might have been more appropriate, since 59.5% of the study sample had a BMI under 30.

For whom was the Internet programme more suitable

Only 21.6% of participants dropped out during the study. The rate of 78.6% of completers was in accordance with other studies on self-help manuals for BED, that is, 78% completion rate for Grilo and Masheb (2005). Dropouts had a greater shape concern and a higher drive for thinness than completers. These characteristics could indicate a more severe eating pathology. People searching treatment for BED are often ambivalent between treating their eating disorder and losing weight. The emphasis on the fact that the online programme was not a weight loss treatment most likely contributed to the dropout rate. A clear motivation from

participants to focus on eating disorder rather than on weight loss and less concern with body shape would have helped them to get better involved in the Internet programme.

Adherence

Adherence was satisfactory. Participants logged on in the programme on average at a frequency of three times a week, more frequently after office hours. The number of e-mails and exercises completed indicated that participants generally followed closely the instructions. The number of days completed in the diary showed that some participants used the Internet programme longer than six months. This may relate to the gains found at follow-up assessment in the Internet Group.

While most of the participants completed the six months intervention, only one third of them ended the whole programme and 73% reached module 6. A greater completion of further modules, which addressed problem solving, assertiveness and cognitive restructuring, would have possibly strengthened the results.

It would be interesting to evaluate adherence as a mediator of outcome. It was not investigated here and will be examined further in a next paper.

Limits and prospects

The use of the *Eating Disorder Examination* (EDE; Fairburn, Cooper, & O'Connor, 2008) at the three evaluations by assessors blinded to randomisation would have enabled a precise view of diagnoses change over the time course of the study. Then sustainability of results at follow-up could be checked only for one group with uncontrolled analyses. A stronger follow-up would be needed to substantiate the results reported here. Finally we chose to include BED and subthreshold BED participants in this study. Results may not be able to be applied generally to a strict DSM-IV BED population.

A direct comparison with a self-help manual would help us conclude on enhancements brought by technology. The Internet self-help treatment programme could be tested in a continuum from an unguided version to a version completed with a number of face-to-face therapy sessions. An unguided version, if efficient, could be used in primary care service as first step treatment.

Conclusion

To conclude, this study demonstrated that an Internet CBT-based self-help treatment programme for BED could be implemented on the Internet and still preserves its efficacy. The Internet programme was well accepted by BED sufferers seeking for a treatment. It had a positive impact on key factors of the illness. For many participants, it was their first eating disorder treatment. Without the visibility provided by the Internet, they would not have known where to ask for help. After the online intervention, some participants who still needed help were more willing to consult a clinician. For these reasons, an Internet self-help treatment programme can be recommended as a first step treatment for BED.

Even if patients and frequently therapists can be prejudiced against the use of new technologies for self-help treatment, this is new without being new (Caspar, 2004). The CBT techniques used widely proved their efficacy before their implementation on the web. Self-help manuals have now been evaluated for many years due to the increasing need of new means to disseminate adequate treatment for eating disorders. After demonstration of acceptance and efficacy, further studies will have to evaluate cost-effectiveness

of treatment techniques based on new technologies in comparison to other types of treatment delivery.

Declaration of interest

Acknowledgements

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