

Changes in physical activity, physical fitness, self-perception and quality of life following a 6-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder

Vancampfort, Davy; Probst, Michel; Adriaens, An; Pieters, Guido; De Hert, Marc; Stubbs, Brendon; Soundy, Andrew; Vanderlinden, Johan

DOI:

[10.1016/j.psychres.2014.05.016](https://doi.org/10.1016/j.psychres.2014.05.016)

License:

Other (please specify with Rights Statement)

Document Version

Peer reviewed version

Citation for published version (Harvard):

Vancampfort, D, Probst, M, Adriaens, A, Pieters, G, De Hert, M, Stubbs, B, Soundy, A & Vanderlinden, J 2014, 'Changes in physical activity, physical fitness, self-perception and quality of life following a 6-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder', *Psychiatry Research*, vol. 219, no. 2, pp. 361-366. <https://doi.org/10.1016/j.psychres.2014.05.016>

[Link to publication on Research at Birmingham portal](#)

Publisher Rights Statement:

NOTICE: this is the author's version of a work that was accepted for publication in *Psychiatry Research*. Changes resulting from the publishing process, such as peer review, editing, corrections, structural formatting, and other quality control mechanisms may not be reflected in this document. Changes may have been made to this work since it was submitted for publication. A definitive version was subsequently published in *Psychiatry Research*, Volume 219, Issue 2, 30 October 2014, Pages 361–366

DOI: 10.1016/j.psychres.2014.05.016

Checked for repository 30/10/2014

General rights

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

Take down policy

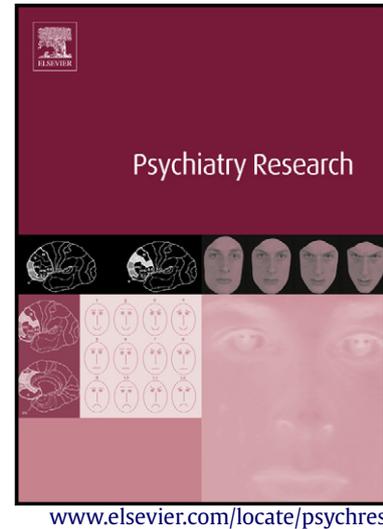
While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact UBIRA@lists.bham.ac.uk providing details and we will remove access to the work immediately and investigate.

Author's Accepted Manuscript

Changes in physical activity, physical fitness, self-perception and quality of life following a six-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder

Davy Vancampfort, Michel Probst, An Adriaens, Guido Pieters, Marc De Hert, Brendon Stubbs, Andy Soundy, Johan Vanderlinden



PII: S0165-1781(14)00387-4
DOI: <http://dx.doi.org/10.1016/j.psychres.2014.05.016>
Reference: PSY8286

To appear in: *Psychiatry Research*

Received date: 30 January 2014
Revised date: 2 May 2014
Accepted date: 12 May 2014

Cite this article as: Davy Vancampfort, Michel Probst, An Adriaens, Guido Pieters, Marc De Hert, Brendon Stubbs, Andy Soundy, Johan Vanderlinden, Changes in physical activity, physical fitness, self-perception and quality of life following a six-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder, *Psychiatry Research*, <http://dx.doi.org/10.1016/j.psychres.2014.05.016>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting galley proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

PSYCHIATRY RESEARCH

Changes in physical activity, physical fitness, self-perception and quality of life following a six-month physical activity counseling and cognitive behavioral therapy program in outpatients with binge eating disorder

Davy Vancampfort^{a,b}, Michel Probst^{a, b}, An Adriaens^a, Guido Pieters^a, Marc De Hert^a,
Brendon Stubbs^c, Andy Soundy^d, Johan Vanderlinden^a

^aUPC KU Leuven, Campus Kortenberg, KU Leuven Department of Neurosciences,
Leuvensesteenweg 517, 3070 Kortenberg, Belgium

^bKU Leuven Department of Rehabilitation Sciences, KU Leuven, Tervuursevest 101, 3001
Leuven, Belgium

^cSchool of Health and Social Care, University of Greenwich, Eltham, London SE9 2UG, UK

^dDepartment of Physiotherapy, University of Birmingham, 52 Pritchatts Road, Birmingham
B15 2TT, UK

Davy Vancampfort, UPC KU Leuven, Campus Kortenberg. Leuvensesteenweg 517, B-3070 Kortenberg, Belgium. Tel.: +32 2 758 05 11; Fax: +32 2 759 9879.

E-mail: Davy.Vancampfort@uc-kortenberg.be

Abstract

The aim of the current study was to explore the associations between changes in the number of binges, physical activity participation, physical fitness, physical self-perception and quality of life following a six-month physical activity counseling and cognitive behavioral program in

patients with binge eating disorder (BED). In total 34 (31 women) outpatients with BED (38.5 ± 10.7 years) completed a six-month one-day per week group-based program. Participants completed the 36-item Short Form Health Survey, the Baecke Physical Activity questionnaire, the Physical Self Perception Profile and performed a six-minute walk test (6MWT) at baseline, after three and six months. Except for physical activity at work, physical strength and self-worth perception, all parameters significantly improved after six months. The effect sizes ranged from -0.33 for the number of binges to 1.67 for participation in sports activities. Significant increases in leisure time physical activity were associated with significant improvements in physical health related quality of life, perceived sports competence and physical fitness and in perceived body attractiveness. The significant reduction in the number of binges was associated with significant improvements in physical health related quality of life. Future research should focus on detailing which techniques can stimulate physical activity participation in patients with BED.

Keywords: Binge Eating; Physical activity; Exercise, Physical fitness; Quality of life, Self-perception

1. Introduction

Binge eating disorder (BED) is characterized by frequent and persistent episodes of binge eating accompanied by feelings of loss of control and marked distress in the absence of regular compensatory behaviors (American Psychiatric Association, 2013). It is associated with specific psychiatric co-morbidity and significant medical and psychosocial impairments (Javaras et al., 2008). Although obesity is not a criterion for BED, there is a strong positive association between weight and BED symptoms and more than 65% of the BED patients are obese (Hudson et al., 2007). Obese binge eaters often show more severe obesity, greater psychopathology, more weight and shape concerns and body dissatisfaction, more negative self-evaluations, lower self-esteem and an impaired health related quality of life compared with obese non-binge eaters (Javaras et al., 2008; Vancampfort et al., 2014). For example, almost 70% of BED patients have at least one additional lifetime psychiatric disorder (Javaras et al., 2008; Grilo et al., 2013). The most common disorders include mood disorder, anxiety disorders, and substance-abuse.

Physical health problems of BED are largely, however not solely (Hudson et al., 2010), due to comorbid obesity and to physical inactivity (Sherwood et al., 1999; Hrabosky et al., 2007; Vancampfort et al., 2014). The level of physical activity reported by obese individuals who binge is approximately half of that of an age and weight matched community sample (Levine et al., 1996). Because of the severe co-morbid psychiatric and physical conditions, BED has been characterized as one of the most difficult psychiatric conditions to treat (Yager, 2008).

Often the treatment for individuals with BED is focused on improving key parameters such as weight and shape concerns, body dissatisfaction, health related quality of life, obesity and physical inactivity (Vanderlinden et al., 2007). Specialized psychotherapies, in particular

cognitive behavioral therapy (CBT) and interpersonal therapy are effective for reducing binge eating, but not all BED patients respond adequately (Vocks et al., 2010). Grilo et al. (2011) previously found that a 24-week CBT program (16* 60-minute group sessions) is superior for producing reductions in binge eating through 12-month follow-up compared with a 24-week (16*60-minute group sessions) behavioral weight loss (BWL) program focusing on making gradual lifestyle changes with goals of moderate caloric restriction and increased physical activity. In contrast, the BWL program produced statistically greater, albeit modest, weight losses during treatment compared with CBT (Grilo et al. 2011). Grilo et al. (2011) did not find support for the utility of a sequential approach in which CBT is delivered first followed by BWL.

Regarding pharmacotherapy in the treatment of BED, Reas and Grilo (2014) recently reported in their review that the evidence base regarding the efficacy of medications for BED still is in its early stages and remains limited. However, topiramate was identified as one medication that may demonstrate some promise in reducing binge eating episodes and enhancing weight loss (Reas and Grilo, 2014). Reas and Grilo (2014) furthermore indicated that combining pharmacotherapy (e.g., fluoxetine) with psychological interventions does not significantly enhance binge eating outcomes, although the addition of certain medications (e.g., desipramine) may enhance the modest weight loss achieved with CBT and BWL.

A particular intervention that may prove useful as an adjunct to the treatment of BED, and which has not been investigated before, is physical activity counseling. There are several reasons for the potential added value. For instance, a recent review on physical activity interventions in persons with BED (Vancampfort et al., 2013) demonstrated that aerobic and yoga exercises might reduce the number of binges and the body mass index (BMI) of BED patients. Furthermore, aerobic exercise reduces depressive symptoms but combining aerobic

exercise with CBT is more effective in reducing depressive symptoms than CBT alone (Vancampfort et al., 2013).

To date, no author has investigated whether combining physical activity counselling and CBT has beneficial effects on participation in physical activity participation, physical fitness, physical self-perception, binge eating and health related quality of life of patients with BED. Further to this, research is needed to consider whether any changes in the number of binges, physical activity participation, physical fitness, physical self-perception and health related quality of life following such an intervention are related. Since lifestyle programs designed with a sound theoretical basis tend to have a greater impact on levels of physical activity participation (Kahn et al., 2002), we applied the principles of the self-determination theory (Deci and Ryan 1985, 2000), behavior change techniques (Abraham and Michie, 2008) and motivational interviewing techniques (Miller and Rollnick, 2002) in this study.

The aim of the current study with a one-group repeated-measures design was to explore any associations between changes in physical activity participation, physical fitness, physical self-perception and health related quality of life following a 6-month physical activity counseling and CBT program in outpatients with BED.

2. Material and methods

2.1. Participants

Before start of the study all local general practitioners, psychiatrists, psychologists, clinical hospitals and patients' groups were informed about the six-month one-day per week physical activity and CBT program by flyers. All were informed that outpatients meeting the DSM-IV criteria for BED (American Psychiatric Association, 1994) could participate in the study. Diagnosis for those who were willing to participate was made at intake by a psychiatrist using the Structured Clinical Interview for DSM-IV Disorders (SCID) (First et al., 1996). We

excluded BED patients with any current psychiatric condition that required psychiatric hospitalization in addition to the weekly multidisciplinary BED program. Also patients who started with a new co-intervention (e.g. pharmacotherapy) for psychiatric reasons during the intervention phase were excluded. We also excluded people with cardiovascular, neuromuscular and endocrine disorders which according to the American Thoracic Society (2002) and the American College of Sports Medicine (2006) might prevent safe participation in physical activity interventions. Data were collected between January 2006 and January 2013. All outcome measures were collected at baseline, at week 12 (three months) and at week 24 (six months). The study procedure was approved by the Scientific and Ethical Committees of the UPC KU Leuven, campus Kortenberg, Belgium. All participants gave their written informed consent prior to start of the study. A total of 47 persons seeking treatment for BED were initially recruited but eight of these subsequently met one or more of the exclusion criteria (two were diagnosed with bulimia nervosa and did not meet DSM-IV criteria for BED, one had locomotor difficulties and one a cardiovascular disorder precluding safe participation in the physical activity counseling program, and four were diagnosed with co-occurring mental illness needing psychiatric hospitalization). Of the 39 included patients with BED (38.5 ± 10.7 years), of which 32 women, nobody declined to participate. Between baseline and month three, one patient dropped out for motivational reasons. Between months three and six two more patients dropped out for motivational reasons and one patient dropped out due to a locomotor disorder, while also one patient started with antipsychotic medication during the intervention and was excluded this way. In total 34 (31 women) patients with BED with a mean age of 38.5 ± 10.7 years completed the entire 6-month program. Except for a significant lower BMI (36.3 ± 1.75 versus 39.8 ± 8.3 , $p=0.0355$) in those who dropped out, there were no significant differences in baseline characteristics between completers ($n=34$) and drop-outs ($n=5$).

2.2. Intervention

All participants followed a group-based six-month one-day per week program. The program consisted of weekly structured group CBT therapy sessions with a maximum of nine participants.

2.2.1. The physical activity counseling program

The physical activity counseling sessions took place from 9 a.m. to 10 a.m. and were executed by a specialist mental health physical therapist. Patients were encouraged to monitor their daily physical activity behavior using a pedometer (Yamax Digiwalker SW-200) and/or a diary. Both were made available throughout the 24 weeks. Individual physical activity goals were set up in collaboration with the patients according to their preferences and abilities. The goals were specified by physical activity type, location, time frame, possible barriers and solutions, and patients were encouraged to write them down in a personal weekly schedule. During the weekly 60 min group sessions, the physical therapist explicitly fostered the psychological needs postulated by the self-determination theory (Deci and Ryan 1985, 2000), i.e. autonomy (e.g., by providing options in type, location, time frame, lifestyle physical activity at work, during transportation, at leisure time or sports), competence (e.g., by providing positive and constructive feedback) and relatedness (e.g., by expressing empathy, facilitating support from the group, and focusing on the importance of involving family, friends or relatives). Moreover, physical activity goals were evaluated and modified if necessary with the patient, barriers were identified and participants were stimulated to persist in physical activity by using behavior change techniques (Abraham and Michie, 2008) and applying motivational interviewing techniques (Miller and Rollnick, 2002).

2.2.2. The cognitive behavioral therapy (CBT) program

The protocol of the CBT program has been described in detail elsewhere (Vanderlinden, 2008; Vanderlinden et al., 2012). In summary, the CBT morning program (10.15 a.m. – 12a.m.) was executed by a mental health nurse, two psychologists (one was also a dietician), and a psychiatrist. The sessions focused on: (1) psycho-education about the risks of obesity and binge eating, (2) increasing motivation to change eating behaviors, (3) learning healthy eating behaviors (including self-monitoring of eating behavior, record keeping, stop dieting if applicable), and (4) increasing awareness of the different triggers to binge. The afternoon program (1.15pm - 4pm), facilitated by the same team, focused in particular on factors eliciting and maintaining the binges. Cognitive restructuring techniques in which patients learned to identify and challenge maladaptive cognitions regarding eating and weigh/shape thoughts were implemented (Vanderlinden, 2008). In addition, the afternoon CBT program focused on: (1) improving self-esteem and assertiveness, (2) identifying, tolerating and expressing emotions, and on (3) preventing relapse, e.g. experimenting with coping strategies in high-risk situations.

2.3. Number of binges

The frequency of binges was assessed using the Eating Disorder Examination Interview (EDE; Fairburn and Cooper 1993), a semi-structured interview. The EDE defines binges as eating unusually large quantities of food with a subjective sense of loss of control, which corresponds to the DSM-IV definition of binge eating (American Psychiatric Association, 1994). The previous week was however used as the time frame and not the previous 28 days as in the original EDE. The EDE was administered at baseline and at treatment completion.

2.4. Physical fitness: the Six Minute Walk Test (6MWT)

The 6MWT was performed according to the American Thoracic Society guidelines (2002) in an indoor corridor with a minimum of external stimuli. Two cones, 25m apart, indicated the length of the walkway. Participants were instructed to walk back and forth around the cones during six minutes, without running or jogging. Resting was allowed if necessary, but walking was to be resumed as soon as the participants were able to do so. The protocol stated that the testing was to be interrupted if threatening physiological symptoms (chest pain, intolerable dyspnea, leg cramps, staggering, diaphoresis, and pale or ashen appearance) appeared. The total distance walked in six minutes was recorded to the nearest decimeter and performed by one trained physical therapist. Standardized encouragements were provided at recommended intervals. Patients were requested to refrain from eating, drinking coffee or smoking during a two-hour period prior to the tests. Prior to the 6MWT, participants were also asked for conditions that might interfere with their performance on the walk test. They were asked whether they suffered intermittently from friction of the skin, urinary stress incontinence, known hip problems or pain, foot or ankle static problems or pain. Furthermore, they were asked if they suffered from knee or low back pain. Directly after the first test, physical complaints or discomforts were recorded. The 6MWT has been shown to be a reliable and valid test to assess the physical fitness of obese patients (Larsson & Reynisdottir, 2008; Beriault et al., 2009).

2.5. Health related quality of life: the MOS 36-item Short Form Health Survey (SF-36)

The SF-36 quality of life questionnaire (Ware et al., 1993) examines eight different items of functioning: physical functioning, role limitations due to physical problems, energy/vitality, bodily pain, social functioning, and role limitations due to emotional problems, mental health

and general health. Scores range from zero to 100, with higher scores indicating a better health state. The four sub-domains: physical functioning, role limitations due to physical problems, bodily pain and general health are summarized into a physical component score (PCS), whereas the four sub-domains: energy/vitality, social functioning, role limitations due to emotional problems and mental health constitute a mental component score (MCS). The Cronbach's alpha of the SF-36 scales ranged from 0.82 (general health) to 0.92 (physical functioning).

2.6. Physical activity: Baecke Physical Activity Questionnaire

The 12-month recall Baecke Physical Activity Questionnaire (Baecke et al., 1982) consists of 16 questions organized in three sections: at work (eight items), sport during leisure time (four items), and during leisure excluding sport (four items). Questions in each section are scored on a five point Likert scale (never, seldom, sometimes, often, always). The measure has demonstrated adequate validity (Westerterp, 1999) and reliability (Pereira et al., 1997). The Cronbach's alpha value of the total score in the current study was 0.73.

2.7. The Physical Self Perception Profile (PSPP)

The PSPP consists of five sub-domain scales: (a) perceived sports competence, (b) perceived physical fitness, (c) perceived body attractiveness, (d) perceived physical strength and (e) physical self-worth (Fox, 1990). Each scale consists of six items presented on a four-point structured-alternative format. Each item on the scale scores from one (least positive perception) to four (most positive perception), combining the item scores gives a sub-domain total score between six to 24, with higher scores representing more positive perceptions. In the Dutch version for psychiatric patients, the subscales for perceived sports competence and

perceived physical fitness are combined resulting in a scale score ranging from 12 to 48 (Van de Vliet et al., 2002). The Cronbach's alpha of the PSPP scales ranged from 0.74 (perceived sports competence and perceived physical fitness) to 0.90 (perceived physical strength).

2.8. Statistical analyses

Descriptive statistics were undertaken and included the mean \pm standard deviation for each continuous variable, median and range for the number of binges during the previous week and one-way frequency tables for the physical symptoms that might interfere with the walk test and for the physical complaints after the walk test. The Shapiro Wilkes test was used to assess the normal distribution of the data. Changes in continuous outcome measures were evaluated using a repeated measures one-way ANOVA with post-hoc Bonferroni-tests. For binominal data McNemar tests were used, also with a Bonferroni corrected significance level. Differences in the number of binges during the previous week between baseline and six months were assessed using the Wilcoxon signed rank test. Associations between significant changes (from baseline to six months) were investigated with Pearson or Spearman's Rho correlation coefficients when appropriate. The significance level was set here at $P < 0.05$. Lastly, within-group effect sizes were calculated using Cohen's d based on the pooled standard deviations for continuous variables and by dividing the z -value by the square root of number of observations for the change in number of binges during the previous week. The established criteria of the effect size, which reflects the effect of an intervention are small (0.20–0.49), medium (0.50–0.79) and large (> 0.80) (Cohen, 1988). The statistical package SPSS version 22.0 (SPSSInc., Chicago, IL) was used for all data analyses.

3. Results

3.1. Changes in clinical variables

The changes in time of the clinical characteristics are presented in Table 1.

Between baseline and three months, significant increases in the distance achieved on the 6MWT, the level of physical activity during participation in sports activities and the physical and mental health related quality of life improved significantly. Related to the physical self-perception after three months only significant increases in the perception of one's own body attractiveness were reported. Between three and six months, the distance achieved on the 6MWT and the perception of one's own body attractiveness improved further. Next to this, also significant improvements in physical activity during leisure time, perceived sports competence and perceived physical fitness were observed in this period.

[Insert Table 1 about here]

The (median) number of binges during the previous week decreased from 5 (range: 2-7) to 0 (0-4) ($z=-2.7$; $P=0.007$).

3.2. Changes in the presence of physical complaints and discomforts before and after the walk test at baseline, after three and six months

The changes in time related to the presence of physical complaints and discomforts before and after the walk test of the 34 participants who completed the six-month program are shown in Table 2. At three months, a significant reduced number of participants reported dyspnea following the 6MWT (20.6% versus 67.6%). No other significant differences were reported. Between three and six months no significant changes were observed. When characteristics were compared between baseline and after six months of physical activity counselling and CBT, there was a significant reduction in both the number of patients reporting dyspnoea

following the 6MWT, as well as the number of patients who reported to suffer from foot or ankle static problems or pain before the test (Bonferroni corrected $p < 0.005 = 0.05/10$).

[Insert Table 2 about here]

3.3. Associations between significant changes in physical activity participation, physical fitness, healthrelated quality of life and physical self-perception

Table 3 gives an overview of the absolute changes in clinical parameters between baseline and six months of physical activity counseling and CBT and the Cohen's d effect sizes in the completers-group. The significant improvements observed corresponded to small to large within-group effect sizes across at post-intervention (Cohen's d range = 0.47 for physical health related quality of life to 1.67 for participation in sports activities) and -0.33 for the number of binges during the previous week

[Insert Table 3 about here]

Significant changes in physical activity participation during leisure time were associated with significant changes in physical health related quality of life ($r=0.34$, $P=0.049$), perceived sports competence and physical fitness ($r=0.35$, $P=0.041$), and in perceived body attractiveness ($r=0.34$, $P=0.046$). Significant changes in the number of binges were associated with significant changes in physical health related quality of life ($r=-0.34$, $P=0.047$), and perceived sports competence and physical fitness ($r=-0.43$, $P=0.012$).

4. Discussion

4.1. General findings

To the best of our knowledge the current study is the first to demonstrate that in persons with BED a significant increase in physical activity participation during leisure time following a six-month physical activity counseling and CBT program is associated with significant

improvements in physical self-perceptions. Significant reductions in the number of binges are associated with significant improvements in physical health related quality of life and perceived sports competence and physical fitness. The current data furthermore shows that musculoskeletal problems were highly prevalent at the start of the program but also, although to a lesser extent, throughout the intervention period. The present study therefore confirms that the physical health of patients with BED should be of major concern in a multidisciplinary treatment protocol. Importantly, obesity might be a key risk factor in the onset and progression of these musculoskeletal conditions. More research is however needed to confirm this hypothesis.

Our study adds to the current knowledge that rehabilitation programs aiming at increasing habitual physical activity in people with BED should take into account physical self-perceptions as potential barriers. One model that links physical self-perceptions to physical activity participation is the exercise and self-esteem model (EXSEM) (Sonstroem and Morgan, 1989; Sonstroem et al., 1991). The EXSEM states that changes in self-perceptions and in particular the belief in one's capabilities to become or remain physically active have an influence on changes in physical activity participation and the other way around. In clinical practice, mental health specialists developing rehabilitation programs to increase physical activity participation in people with BED should therefore be sensitive to the potentially detrimental effects of physical self-perceptions. This is particularly important since obese people with BED perceive themselves as less competent in undertaking physical activity than obese people without BED (Vancampfort et al., 2014). Various studies based on the EXSEM model (Sonstroem et al., 1991) suggest that positive experiences when being more physically active could enhance physical activity self-efficacy, which in turn may benefit one's physical self-perceptions and ultimately even lead to changes in self-esteem and health related quality of life.

4.2. Limitations

The findings of the present study must be interpreted with caution due to some methodological limitations. First, it must be strongly emphasized that the present study was exploratory. The one-group repeated-measures research design employed in this study sets significant limitations on the conclusions and generalizability that can be drawn from the current findings. In particular, because no control group (e.g. controls assigned to a wait list condition or treatment as usual) or control intervention (e.g. CBT alone or BWL alone) was utilized, changes in physical activity participation, physical fitness, physical self-perception and health related quality of life of patients cannot be assumed to be directly attributed to the intervention. Secondly, physical activity participation was only measured with a self-report questionnaire which is prone to both systematic and random errors (Soundy et al., 2007). Thirdly, the sample size was rather small and consisted almost completely of female participants, both of these factors will need to be considered when attempting to generalize our findings. Fourthly, as no follow-up period was assessed after the study cessation, it is not known whether improvements in physical self-perception and health related quality of life and reductions in the number of binges were sustained or whether patients continued to be physically active.

4.3. Future research

Research over a more concentrated period of time, including a control group using longer term outcomes is highly needed before any firm conclusions can be made related to the effects of a combination of physical activity counselling and CBT on physical fitness, physical self-perception and health related quality of life in patients with BED. Future research should also

investigate which techniques can stimulate positive experiences while being physically active and consequently which techniques support an enhanced sense of personal control over the body and its functioning in these patients. For example, future research should investigate in greater detail in which way the principles of the self-determination theory applied in this study (Deci and Ryan 1985, 2000) might have enhanced any changes in physical activity participation. Future research should also examine whether the use of the self-determination theory might be one of the underlying reasons for the low drop-out observed in the current study when compared with other lifestyle studies in BED (Levine et al., 1996; Grilo et al., 2011). It might be hypothesized that supporting and stimulating feelings of competence was facilitated by the nature of the physical activity counseling program. Feelings of competence may be facilitated through the promotion of environments in which self-referenced standards and indicators of improvement are adopted as opposed to competitive situations in which evaluated outcomes are dependent upon the performance of others (Springer et al., 2013). By providing individual, concrete and realistic weekly schemes, which were intended to progressively increase the physical activity volume until a preferred level, participants were likely to experience individual successes. Feelings of control might have been facilitated as well by providing autonomy. In practice, autonomy might have been achieved by providing choices to patients, supporting their initiatives, offering relevant personal information for changing behavior and using autonomy supportive language (e.g. “may” and “could” rather than “should” and “must”) which was facilitated in this study by using the motivational interviewing techniques (Miller and Rollnick, 2002). Finally, interpersonal relatedness might have been facilitated in the intervention used by stimulating the participants to involve meaningful others while being physically active. It may also be suggested that physical activity counseling in a group setting provides a venue for social support from other patients, thereby increasing participation. Being able to test out new skills with trusted others is also an

important part of building competence (Deci and Ryan, 2000). Additional studies identifying moderators of treatment response for patients with BED (e.g. personality traits) will likely enhance the efficacy of combined physical activity counselling and CBT interventions and will assist in treatment development. Future studies investigating the role of physical activity participation on physical and mental health related quality of life in persons with BED should furthermore incorporate an objective measure of physical activity (e.g. pedometers or accelerometers). In the same way, future studies investigating the role of physical activity participation on physical fitness should incorporate a more multidimensional assessment of physical fitness including morphological, muscular, motor, cardiorespiratory, and metabolic fitness parameters. Lastly, research is needed to investigate more in detail the cost-effectiveness and feasibility of a combined physical activity counseling and CBT program in improving the physical and mental health of patients with BED. Many existing studies for the treatment of BED have used much briefer interventions (e.g., 60-90 minute groups rather than day-long groups) over a comparable period of time (e.g., 24 weeks) (Vocks et al., 2010; Grilo et al., 2011). Future studies could for example compare the efficacy on physical and mental health parameters and the cost-effectiveness of a combined physical activity counseling and CBT program with CBT alone, or with a BWL program.

In conclusion, although with limitations, our study indicates that patients with BED following a six-month physical activity counseling and CBT program are more physically active, which is related to improvements in physical self-perception and health related quality of life. Decreases in BMI following six months of physical activity counselling and CBT are on its turn associated with improvements in physical fitness.

Funding and conflicts of interest

Davy Vancampfort is funded by the Research Foundation – Flanders (FWO-Vlaanderen). The authors have no conflicts of interest to declare related to this study. We also certify that none of the authors have a direct interest in the results of the research supporting this article.

Acknowledgements

The authors would like to thank Tilly Hauman (KU Leuven Department of Neurosciences, UPC KU Leuven, campus Kortenberg, Kortenberg, Belgium) for her assistance in the data collection.

References

- Abraham, C., Michie, S., 2008. A taxonomy of behavior change techniques used in interventions. *Health Psychology* 27(3), 379-387.
- American College of Sports Medicine, 2006. ACSM's resource manual for guidelines for exercise testing and prescription, 5th ed. Lippincott Williams & Wilkins, Philadelphia.
- American Psychiatric Association, 1994. Diagnostic and Statistical Manual of Mental Disorders, 4th ed. American Psychiatric Association, Washington, DC.
- American Psychiatric Association, 2013. Diagnostic and Statistical Manual of Mental Disorders, 5th ed. American Psychiatric Association, Washington, DC.
- American Thoracic Society, 2002. ATS statement: guidelines for the six-minute walk test. *American Journal of Respiratory and Critical Care Medicine* 166, 111-117.
- Baecke, J., Burema, J., Frijters, J., 1982. A short questionnaire for the measurement of habitual physical activity in epidemiological studies. *American Journal of Clinical Nutrition* 36, 936-942.

- Beriault, K., Carpentier, A.C., Gagnon, C., Ménard, J., Baillargeon, J.P., Ardilouze, J.L.,
Langlois, M.F., 2009. Reproducibility of the 6-minute walk test in obese adults.
International Journal of Sports Medicine 30, 725-727.
- Cohen, J., 1988. *Statistical analysis for the behavioral sciences*, 2nd ed. Lawrence Erlbaum
Associates, Hillsdale NJ.
- Deci, E.L., Ryan, R.M., 1985. *Intrinsic motivation and self-determination in human
behaviour*. Plenum Press, NY.
- Deci, E.L., Ryan, R.M., 2000. The “what” and “why” of goal pursuits: Human needs and the
self-determination of behavior. *Psychological Inquiry* 11, 227-268.
- Fandiño, J., Moreira, R.O., Preissler, C., Gaya, C.W., Papelbaum, M., Coutinho, W.F.,
Appolinario, J.C., 2010. Impact of binge eating disorder in the psychopathological
profile of obese women. *Comprehensive Psychiatry* 51, 110-114.
- Fairburn, C. G., Cooper, Z. (1993). *The Eating Disorder Examination*, 12th ed. In:
Fairburn, C.G., Wilson, G.T. (Eds.), *Binge eating: Nature, assessment, and
treatment*. Guilford Press, NY, pp. 317–360.
- First, M.B., Spitzer, R.L., Gibbon, M., Williams, J.B.W., 1996. *Structured clinical
interview for DSM-IV Axis I Disorders - Patient Edition (SCID-I/P)*, 2nd ed. New
York State Psychiatric Institute, NY.
- Fox, K.R., 1990. *The Physical Self-Perception Profile manual*. Office for Health Promotion
Northern Illinois University, DeKalb IL.
- Grilo, C.M., Masheb, R.M., Wilson, G.T., Gueorguieva, R., White, M.A., 2011. Cognitive-
behavioral therapy, behavioral weight loss, and sequential treatment for obese patients
with binge-eating disorder: a randomized controlled trial. *Journal of Consulting and
Clinical Psychology* 79(5), 675-685.
- Grilo, C.M., White, M.A., Barnes, R.D., Masheb, R.M., 2013. *Psychiatric disorder*

- comorbidity and correlates in an ethnically diverse sample of obese patients with binge eating disorder in primary care settings. *Comprehensive Psychiatry* 54, 209-216.
- Hrabosky, J.I., White, M.A., Masheb, R.M., Grilo, C.M., 2007. Physical activity and its correlates in treatment-seeking obese patients with binge eating disorder. *International Journal of Eating Disorders* 40, 72-76.
- Hudson, J.I., Hiripi, E., Pope, H.G. Jr., Kessler, R.C., 2007. The prevalence and correlates of eating disorders in the National Comorbidity Survey Replication. *Biological Psychiatry* 61, 348-358.
- Hudson, J.I., Lalonde, J.K., Coit, C.E., Tsuang, M.T., McElroy, S.L., Crow, S.J., Bulik, C.M., Hudson, M.S., Yanovski, J.A., Rosenthal, N.R., Pope, H.G. Jr., 2010. Longitudinal study of the diagnosis of components of the metabolic syndrome in individuals with binge-eating disorder. *American Journal of Clinical Nutrition* 91(6), 1568-1573.
- Javaras, K.N., Pope, H.G., Lalonde, J.K., Roberts, J.L., Nillni, Y.I., Laird, N.M., Bulik, C.M., Crow, S.J., McElroy, S.L., Walsh, B.T., Tsuang, M.T., Rosenthal, N.R., Hudson, J.I., 2008. Co-occurrence of binge eating disorder with psychiatric and medical disorders. *Journal of Clinical Psychiatry* 69, 266-273.
- Kahn, E.B., Ramsey, L.T., Brownson, R.C., Heath, G.W., Howze, E.H., Powell, K.E., Stone, E.J., Rajab, M.W., Corso P. (2002) The effectiveness of interventions to increase physical activity: a systematic review. *American Journal of Preventative Medicine* 22, 73-107.
- Larsson, U.E., Reynisdottir, S., 2008. The six-minute walk test in outpatients with obesity: reproducibility and known group validity. *Physiotherapy Research International* 13(2), 84-93.
- Levine, M.D., Marcus, M.D., Moulton, P., 1996. Exercise in the treatment of binge eating disorder. *International Journal of Eating Disorders* 19, 171-177.

- Miller, W.R., Rollnick, S., 2002. Motivational interviewing. Preparing people for change. The Guilford Press, NY.
- Pereira, M. A., Fitzgerald, S. J. Gregg, E.W. Joswiak, M.L., Ryan, W.J., Suminski, R.R., Utter, A.C., Zmuda, J.M., 1997. A collection of physical activity questionnaires for health-related research. *Medicine and Science in Sports and Exercise* 29, S1–S205.
- Reas, D.L., Grilo, C.M., 2014. Current and emerging drug treatments for binge eating Disorder. *Expert Opinion on Emerging Drugs* 19(1), 99-142.
- Sherwood, N.E., Jeffery, R.W., Wing, R.R., 1999. Binge status as a predictor of weight loss treatment outcome. *International Journal of Obesity* 23, 485-493.
- Sonstroem, R.J., Morgan, W.P., 1989. Exercise and self-esteem: rationale and model. *Medicine and Science in Sports and Exercise* 21, 329-337.
- Sonstroem, R.J., Harlow, L.L., Gemma, L.M., Osborne, S., 1991. Test of structural relationships within a proposed exercise and self-esteem model. *Journal of Personality Assessment* 56, 348-364.
- Soundy, A., Taylor, A., Faulkner, G., Rowlands, A., 2007. The psychometric properties of the seven-day physical activity recall questionnaire in individuals with severe mental illness. *Archives of Psychiatric Nursing* 21, 309-316.
- Springer, J.B., Lamborn, S.D., Pollard, D.M., 2013. Maintaining physical activity over time: the importance of basic psychological need satisfaction in developing the physically active self. *American Journal of Health Promotion* 27(5), 284-293.
- Vancampfort, D., Vanderlinden, J., De Hert, M., Adámkova, M., Skjaerven, L.H., Matamoros, D.C., Lundvik Gyllensten, A., Gómez-Conesa, A., Ijntema, R., Probst, M., 2013. A systematic review on physical therapy interventions for patients with binge eating disorder. *Disability and Rehabilitation* 35(26), 2191-2196.

- Vancampfort, D., De Herdt, A., Vanderlinden, J., Lannoo, M., Soundy, A., Pieters, G., Adriaens, A., De Hert, M., Probst, M. 2014. Health related quality of life, physical fitness and physical activity participation in treatment-seeking obese persons with and without binge eating disorder. *Psychiatry Research*. doi.org/10.1016/j.psychres.2014.01.015i.
- Vanderlinden, J. 2008. *Boulimie en eetbuien overwinnen in 10 stappen (Overcoming bulimia nervosa in ten steps)*. Lannoo, Tielt.
- Vanderlinden, J., Buis, H., Pieters, G., Probst, M., 2007. Which elements in the treatment of eating disorders are necessary 'ingredients' in the recovery process? A comparison between the patient's and therapist's view. *European Eating Disorders Review* 15(5), 357-365.
- Vanderlinden, J., Adriaens, A., Vancampfort, D., Pieters, G., Probst, M., Vansteelandt, K., 2012. A cognitive-behavioural therapeutic program for patients with obesity and binge eating disorder: short- and long term follow-up data of a prospective study. *Behavioral Modification* 36, 670-686.
- Van de Vliet, P., Knapen, J., Onghena, P., Fox, K.R., Van Coppenolle, H., David, A., Pieters, G., Peuskens, J., 2002. Assessment of physical self-perceptions in normal Flemish adults versus depressed psychiatric persons. *Personality and Individual Differences* 32, 855-863.
- Vocks, S., Tuschen-Caffier, B., Pietrowsky, R., Rustenbach, S.J., Kersting, A., Herpertz, S., 2010. Meta-analysis of the effectiveness of psychological and pharmacological treatments for binge eating disorder. *International Journal of Eating Disorders* 43(3), 205-217.
- Ware, J.E., Snow, K.K., Kosinski, M., Gandek, B., 1993. *SF-36 Health Survey: Manual and interpretation guide*. Nimrod Press, Boston MA.

Westerterp, K.R., 1999. Assessment of physical activity level in relation to obesity: current evidence and research issues. *Medicine and Science in Sports and Exercise* 31, S522-S525.

Yager, J., 2008. Binge eating disorder: The search for better treatments. *American Journal of Psychiatry* 165, 4-6.

Accepted manuscript

Table 1

Differences in demographical and clinical characteristics following 3 and 6 months physical activity counselling and cognitive behavioural therapy in patients with binge eating disorder (n=34)

Variables	Baseline	3 months	6 months	F	P
BMI (kg/m ²)	39.8±8.3	38.3±8.3	37.4±8.4	0.63	0.54
6MWT (m)	536.5±97.7 ^{a,b}	595.8±95.8 ^{b,c}	626.9±88.3 ^{a,c}	8.4	<0.001*
Baecke work score	2.8±0.7	2.8±0.6	2.9±0.6	0.5	0.69
Baecke leisure time score	2.3±0.7 ^a	2.7±0.7	2.9±0.7 ^a	6.0	0.003*
Baecke sports score	1.8±0.6 ^{a,b}	2.5±0.6 ^b	2.6±0.8 ^a	14.5	<0.001*
SF-36 physical HRQL	48.2±22.1 ^{a,b}	58.9±23.2 ^b	66.7±19.3 ^a	6.5	0.002*
SF-36 mental HRQL	43.9±23.5 ^{a,b}	61.2±22.2 ^b	64.8±20.7 ^a	8.8	<0.001*
PSPP sports + physical fitness	17.5±4.4 ^a	19.3±5.8 ^c	21.9±5.4 ^{a,c}	5.9	0.004*
PSPP body attractiveness	7.6±2.2 ^{a,b}	8.3±2.5 ^{b,c}	9.9±3.5 ^{a,c}	6.4	0.002*
PSPP physical strength	10.8±3.3	11.6±3.7	12.7±3.7	2.4	0.10
PSPP physical self-worth	8.5±2.5	9.4±2.8	10.7±3.7	4.5	0.014

Data expressed as mean± standard deviation, * repeated measures one-way ANOVA

significant when $P < 0.0045 = 0.05/11$, post-hoc Bonferroni ($P < 0.05$): a=baseline versus 6 months; b= baseline versus 3 months; c=3 months versus 6 months; BMI= body mass index; HRQL= Health Related Quality of Life; 6MWT= six minute walk test distance; PSPP= Physical Self Perception Profile.

Table 2

Differences in the presence of physical complaints and discomforts before and after the walk test at baseline, after 3 and 6 months of physical activity counselling and cognitive behavioural therapy in patients with binge eating disorder (n=34)

	Baseline	3 months
Friction of the skin pre	9 (26.5%)	5 (14.7%)
Urinary stress incontinence pre	7 (20.6%)	5 (14.7%)
Hip pain pre	4 (11.7%)	4 (11.7%)
Foot static problems or pain pre	18 (52.9%) ^a	12 (35.3%)
Back pain pre	27 (79.4%)	22 (64.6%)
Knee pain pre	27 (79.4%)	23 (67.6%)
Musculoskeletal pain post	18 (52.9%)	13 (38.2%)
Dyspnoea post	23 (67.6%) ^{a,b}	7 (20.6%) ^b
Muscular fatigue post	12 (35.3%)	6 (17.6%)
Tibia pain post	16 (47.0%)	10 (29.4%)

McNemar tests ($P < 0.005 = 0.05/10$): a=baseline versus 6 months; b= baseline versus 3 months.

Table 3

Absolute significant changes in clinical characteristics and Cohen's *d* following 6 months physical activity counseling and cognitive behavioural therapy in completers (n=34).

Variable	mean change \pm standard deviation	Cohen's <i>d</i>
6MWT (m)	90.4 \pm 68.4	1.00
Baecke leisure time score	0.6 \pm 0.7	0.86
Baecke sports score	0.9 \pm 0.7	1.67
SF-36 physical HRQL	9.3 \pm 14.2	0.47
SF-36 mental HRQL	3.6 \pm 19.7	0.75
PSPP sports + physical fitness	4.4 \pm 4.0	0.89
PSPP body attractiveness	2.4 \pm 2.5	0.78

BMI=body mass index; 6MWT=six minute walk test distance; HRQL=Health Related Quality of Life; PSPP=Physical Self Perception Profile.