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*Is there an association between our personality and
our weight?*

Systematic review and meta-analysis of the
association between
Binge-Eating-Disorder and personality traits
in obesity and pre-obesity

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Abstract

Background and Context

Binge-Eating-Disorder is common in patients presenting with obesity or overweight/pre-obesity. The origin of Binge-Eating-Disorder however has remained elusive, including its association with personality traits. Confirming an association between the two would be of major importance to all those working in the field of eating disorders as well as in the field of obesity.

Objective

The objective of the present study was to look for an association between Binge-Eating-Disorder and specific personality traits in pre-obese or obese people. To fulfil this objective, studies investigating possible connections between those elements were critically examined and summarized.

Data Extraction and Synthesis

The present study was designed as a systematic search following the general guidelines put forward in the PRISMA-Statement (Preferred Reporting Items for Systematic reviews and Meta-Analysis) for conducting and reporting systematic reviews. This was followed by meta-analyses involving nine studies using the software Comprehensive Meta-Analysis version 2 (CMA v2.2.030) (BioStat, Inc, Englewood, NJ). Meta-analyses focussed on three pairs of comparisons; namely, “pre-obese/obese with BED vs. Normal-weight without BED”, “pre-obese/obese with BED vs. Pre-Obese/Obese without BED” and “Pre-Obese/Obese without BED vs. Normal-weight without BED”, on six personality traits: Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Reward Dependence and Novelty Seeking. This yielded 52 specific group comparisons.

Results

The first comparison showed that pre-obese or obese people with Binge-Eating-Disorder scored higher than people with normal-weight without Binge-Eating-Disorder on five of the six personality traits, namely Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness and Novelty Seeking. The second comparison showed that pre-obese or obese people with Binge-Eating-Disorder scored higher than pre-obese or obese people without Binge-Eating-Disorder on four of the six personality traits, namely Impulsivity, Perfectionism, Harm Avoidance and Ineffectiveness. The third comparison showed that pre-obese or obese people without Binge-Eating-Disorder scored higher

than people with normal-weight without Binge-Eating-Disorder on two of the six personality trait, namely Impulsivity and Ineffectiveness.

Conclusion

The results of the present study give support to Binge-Eating-Disorder as a distinct disorder that might be independent from obesity. They suggest that any treatment of Binge-Eating-Disorder should give full consideration to the following personality traits: Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness and Novelty Seeking. This could be achieved in particular using specific psychological interventions such as strategies of impulse-control, cognitive restructuring, assertiveness-training, coping strategies and relaxation exercises. In addition, these character traits should be given particular attention in future studies investigating the causes and/or accompanying features of obesity as well as in studies examining the effect of psychological, pharmacological or bariatric treatments for pre-obese or obese individuals with Binge-Eating-Disorder seeking weight reduction.

Keywords: Binge-Eating-Disorder, pre-obesity, overweight, Obesity, Personality Traits.

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1 Introduction

Pre-obesity and obesity have become a major problem in industrialised countries. They are defined by the Body Mass Index (BMI), which divides the subjects' mass by the square of their height: $\text{BMI} = \text{kilograms/meters}^2$. The definition used by the World Health Organisation (WHO, 2004) states that adult pre-obesity corresponds to a BMI ranging from 25 to 29.9 and adult obesity to a BMI equal or higher than 30 (see Table 1). Normal weight corresponds to a BMI ranging from 18.50 to 24.99. These weight classes are only applicable for adults¹.

Table 1: WHO classification of adult normal-weight, overweight and obesity according to BMI

Classification	BMI (kg/m ²)
Normal weight	18.50-24.99
Overweight	≥25.00
Pre-obesity	25.00 - 29.99
Obese	≥30.00
Obesity class I	30.00 - 34.99
Obesity class II	35.00 - 39.99
Obesity class III	≥40.00

Source: Adapted from WHO, 1995, WHO, 2000 and WHO, 2004.

During the last 20 years, there have been substantial changes in the BMI-distribution in the general population. An increase in BMI was observed by Helmchen and Henderson (2004). By reporting the descriptive statistics of the age- and year-specific distributions of BMI in adult men, they found that the prevalence of obesity has increased from 3.4% to 35% in the last 100 years. Flegal, Carroll, Ogden and Curtin (2010), who examined 5555 adults in the United States of America between the years 1999 and 2008, found similar results to those by Helmchen et al., concluding that the prevalence of obesity was 32.2% among adult men and 35.5% among adult women. A recent study on children and adolescents in the United States of America showed that the BMI has increased substantially in the young population as well (Ogden, Carroll, Curtin, Lamb & Flegal, 2010).

These are alarmingly high numbers considering that obesity is one of the leading preventable causes of death worldwide (Mokdad, Marks, Stroup & Gerberding, 2004). In addition, obesity is a major risk factor for numerous morbidities and thus significantly reduces physical health-related

¹ BMI values are used differently in adults and in children and teenagers. In children and teenagers, these values are age- and sex-specific.

quality of life (de Zwaan, 2009). In particular, obesity is a major risk factor for hyperglycaemia including type 2 diabetes, hypertension, fatty liver, high cholesterol blood levels, gallstones, sleep apnoea, osteoarthritis and polycystic ovary disease, with hyperglycaemia, hypertension and hypercholesterolemia leading in turn to atherosclerotic cardiovascular disease or ASCVD (Grundy, 2004). Mental health-related quality of life also is significantly associated with obesity. As de Zwaan (2009) points out, many comorbid mental and somatic disorders show significantly different prevalence rates between weight categories (Normal weight, Obesity Grade 1, Obesity Grade 2 and Obesity Grade 3). As seen in Table 2, obese participants exhibit the highest frequencies in the point-prevalence of mental disorders compared to normal-weight participants.

Table 2: Point-Prevalence of Mental Disorders in Participants With Varying Degrees of Obesity, as Assessed by Interview (Percent of Participants)

	Normal Weight (N_167)	Obesity Grade 1 (N_120)	Obesity Grade 2 (N_103)	Obesity Grade 3 (N_250)
Substance use	9.1	12.2	5.5	7.0
Mood disorders	1.8	8.9	8.3	9.0
Anxiety disorders	4.3	12.2	8.3	15.2
Posttraumatic stress disorder	0	1.6	1.8	1.2
Somatoform disorders	2.4	3.3	2.8	10.7
Eating disorders	0	2.5	1.9	4.4

Source: Adapted from de Zwaan, 2009.

In recent years, the idea that there are two different kinds of obesity has gained ground (Fassino et al., 2002): obesity associated with binge eating (non-purging) and obesity in the absence of binge eating. Obese individuals with binge eating show significantly more eating and weight related pathology and a more severe psychopathology compared to obese individuals without binge-eating (Marcus, Wing, Ewing, Kern, Gooding & McDermott, 1990; Telch & Agras, 1994; Yanovski, Nelson, Dubbert & Spitzer, 1993). Further studies, including those by De Zwaan (2001; 2009) and Yanovski (2003), have shown that obesity often can be linked to eating disorders and in particular to Binge-Eating-Disorder. In addition, there seems to be a positive correlation between the severity of binge-eating and the degree of obesity (Bruce & Agras, 1991).

During the past decade, a considerable number of publications have appeared on different aspects of Binge-Eating-Disorder. Personality seems to be potentially important in the aetiology, maintenance, and treatment of this eating disorder (Bruce & Steiger, 2006; Kendall & Clarkin, 1992).

Since personality dimensions seem to play an important role in Binge-Eating-Disorder, it is important to identify the specific underlying personality dimensions in order to better understand this disorder. Taking into account those dimensions may help to adapt and to optimize treatment modalities that are currently available for Binge-Eating-Disorder.

The present study is a systematic review and meta-analyses of studies examining the association of Binge-Eating-Disorder and specific personality traits. The purpose of the study is to identify personality dimensions that are relevant in the development and maintenance, as well as for the treatment of Binge-Eating-Disorder.

1.1 Binge-Eating-Disorder (BED)

Binge-Eating-Disorder first was described by the psychiatrist Albert Stunkard in 1959 as “Night-Eating-Syndrome” (NES), a distinct eating pattern in some obese individuals, although then it was not yet classified as a separate eating disorder. Later NES was changed to BED (Binge-Eating-Disorder), the latter defining the same bingeing-type eating behaviour but no longer restricted to its nocturnal component.

The fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; American Psychiatric Association, 1994) includes a description of Binge-Eating-Disorder, although not in the official text, but only in Appendix B “Criteria Sets and Axes Provided for Further Study”. The same description was included in the Text Revision of DSM-IV or DSM-IV-TR (American Psychiatric Association, 2000). The provisional DSM-IV-TR criteria for Binge-Eating Disorder (307.50) are shown in Table 3. It is important to note that in Binge-Eating-Disorder, binge eating is not associated with the use of inappropriate compensatory behaviours (e.g., purging, fasting or excessive exercise) that characterize Anorexia Nervosa or Bulimia Nervosa.

Table 3: Research Criteria for Binge-Eating-Disorder (DSM-IV, Appendix B)

A. Recurrent episodes of binge eating. An episode of binge eating is characterized by both of the following:

1. Eating, in a discrete period of time (e.g., within any 2-hour period), an amount of food that is definitely larger than most people would eat in a similar period of time under similar circumstances
2. A sense of lack of control over eating during the episode (e.g., a feeling that one cannot stop eating or control what or how much one is eating)

B. The binge-eating episodes are associated with three (or more) of the following:

- 1.eating much more rapidly than normal
- 2.eating until feeling uncomfortably full
- 3.eating large amounts of food when not feeling physically hungry
- 4.eating alone because of being embarrassed by how much one is eating
- 5.feeling disgusted with oneself, depressed, or very guilty after overeating

C. Marked distress regarding binge eating is present.

D. The binge eating occurs, on average, at least 2 days a week for 6 months.

E. The binge eating is not associated with the recurrent use of inappropriate compensatory behaviour and does not occur exclusively during the course of Bulimia Nervosa or Anorexia Nervosa.

Source: Adapted from DSM-IV-TR, 2000.

In DSM-IV-TR (2000), Binge-Eating-Disorder still is classified under “Eating Disorders Not Otherwise Specified” (EDNOS). There is still a debate about whether Binge-Eating-Disorder really is a disorder on its own or if it is just a subtype of overeating (Fairburn, Welch & Hay, 1993; Stunkard & Allsion, 2003; Grucza, Przybeck & Cloninger, 2007). A more detailed look on this debate will be given in 5.5 *Implications for Binge-Eating-Disorder as a distinct eating disorder*.

In DSM-5 (an Arabic “5” being used instead of a roman number), scheduled to appear in May 2013, Binge-Eating-Disorder will be classified as a disorder in its own right under the provisional code K 05 reserved for “Binge Eating Disorder” (see the current proposition on the Internet under www.dsm5.org). In the DSM-5 definition of Binge-Eating-Disorder, the frequency of binge eating, as proposed at this time, will be changed from the initially “at least 2 times a week for 6 months” to “at least once a week for three months”.

The rationale for changing the frequency criterion of bingeing in DSM-5 rests upon the results of a study by Trace et al. (2011). The authors examined 13.295 women with regard to their lifetime histories of binge eating, Bulimia Nervosa and Binge-Eating-Disorder using an expanded version of the Structured Clinical Interview for DSM-IV or SCID-IV. They assessed three different duration criteria for Binge-Eating-Disorder (1, 3 and 6 months) to explore the impact of changing the required duration on lifetime prevalence (duration: from “for 6 months” to “for three months”). Changing from 1 month to 3 months and then to 6 months, the prevalence of Binge-Eating-Disorder decreased only slightly. They also examined the impact that a change in frequency of binges would have on lifetime prevalence and showed that “the lifetime prevalence estimates of BN and BED increased linearly as frequency criterion decreased” (p.4) (frequency: from “at least 2 times a week” to “at least once a week”). According to Trace et al., these changes in duration and frequency in the appearance of binge eating would however not significantly alter the lifetime prevalence of Binge-Eating-Disorder and Bulimia Nervosa. On the other hand, they would considerably simplify the diagnosis.

The next three sections will elaborate on the distribution of Binge-Eating-Disorder in the general population, the risk factors and possible causes of Binge-Eating-Disorder and treatment effects. Results can differ, since different instruments have been used to assess Binge-Eating-Disorder. The most commonly used instruments to diagnose Binge-Eating-Disorder are the Patient Health Questionnaire (PHQ; Spitzer, Kroenke & Williams, 1999), the Eating Disorder Questionnaire (EDQ; Fairburn & Beglin, 1994), the Eating Disorder Examination (EDE; Fairburn & Cooper, 1993), the Structured Clinical Interview for DSM-IV (SCID-IV; First, Spitzer, Gibbon & Williams, 1995) and the Eating-Disorder Inventory (EDI; Garner, Olmsted & Polivy, 1983; EDI-2; Garner, 1991). The severity

of Binge-Eating-Disorder can be assessed with the Binge-Eating-Scale (Gormally, Black, Daston & Rardin, 1982).

1.1.1 Epidemiology of Binge-Eating-Disorder

The prevalence of Binge-Eating-Disorder has been studied in the general population as well as in more specific populations, in particular in patients seeking treatment for weight control. As could be expected, the prevalence rates of Binge-Eating-Disorder are not the same depending on the population being investigated.

To determine the prevalence of Binge-Eating-Disorder in the general population, Grucza, Przybeck and Cloninger (2007) screened 917 individuals of a community sample for Binge-Eating Disorder (seven were excluded after reporting symptoms of bulimia) using the Patient Health Questionnaire (PHQ). They found that 60 cases (6.6%) met the criteria for Binge-Eating-Disorder², with no significant difference in percentage of positive screening for Binge-Eating-Disorder between males (6.8%) and females (6.4%). A lower prevalence for Binge-Eating-Disorder was shown in a study by Hudson, Hiripi, Pope Jr. and Kessler (2007). They conducted a nationally representative face-to-face household survey in the USA between 2001 and 2003, involving 9282 English-speaking adults aged 18 and above, as part of the National Comorbidity Survey Replication (NCS-R). Diagnoses were based on Version 3.0 of the World Health Organization Composite International Diagnostic Interview (CIDI). The results showed a lifetime prevalence of Binge-Eating-Disorder (meeting the provisional criteria included in Appendix B of DSM-IV) of 3.5% among women and 2.0% among men.

Although Binge-Eating-Disorder is not limited to obese individuals, overweight and obese individuals who seek treatment for weight control present with Binge-Eating-Disorder more often than people who are not obese. In individuals who seek treatment for weight control, prevalence rates as high as 30% have been found (de Zwaan, 2001). Furthermore, Bruce and Agras (1991) found a positive correlation between the severity of Binge-Eating-Disorder and the degree of obesity.

² A diagnosis of Binge-Eating-Disorder was given for subjects answering affirmatively to only 3 questions: "Do you often feel that you cannot control what or how much you eat?", "Do you often eat, within any 2-hour period, what most people would regard as an unusually large amount of food?" and "Has this been as often, on average, as twice a week for the last 3 months?"

1.1.2 Risk Factors and Causes of Binge-Eating-Disorder

A number of potential risk factors for Binge-Eating-Disorder have been examined in several studies. There does not seem to be one exclusive cause for developing the disorder. In fact, it seems much more likely that a combination of biological factors, psychosocial factors and personality characteristics are involved. Biological and psychosocial risk factors are described below. Risk factors related to personality will be described separately under *1.3. Binge-Eating-Disorder and Personality Traits*.

Biological abnormalities may contribute to binge eating and Binge-Eating-Disorder. Collecting detailed phenotypic data, Branson et al. (2003) examined 469 severely obese white subjects (370 women and 99 men, mean age 41.0, BMI 44.1 ± 2.0). Twenty-four obese subjects had melanocortin-4-receptor (MC4R) mutations. Branson et al. concluded that binge eating is a major phenotypic characteristic of subjects with a mutation in MC4R, a candidate gene for the control of eating behaviour. Other researchers suggest that modifications in the brain are responsible for Binge-Eating-Disorder. Monteleone et al. (2005) believe that changes in the hypothalamus may influence the mediation of the rewarding aspects of the aberrant eating behaviours occurring in Binge-Eating-Disorder. He suggests this operates through the involvement of arachidonoyl ethanolamide or AEA (an endogenous cannabinoid neurotransmitter that binds to both central cannabinoid - CB1 - and peripheral cannabinoid -CB2 - receptors). Bulik, Sullivan and Kendler (2003) tried to determine the extent of overlap between genetic and environmental factors that contribute to the liability to obesity and binge eating by studying 2163 female twins. Their results suggest that binge eating and obesity may be heritable conditions, but with only a modest overlap in the genetic risk factors that increase liability to each condition.

Some researchers suggested that the ethnic affiliation of a person could be a risk factor for Binge-Eating-Disorder whereas others report no differences regarding ethnic groups. Pike, Dohm, Striegel-Moore, Wilfey and Fairburn (2001) compared a group of 52 black and 98 white women with Binge-Eating-Disorder and assessed eating and psychiatric symptoms using interviews and self-report questionnaires. Results showed that black and white women with Binge-Eating-Disorder differed significantly on several eating disorder features such as binge frequency, restraint, history of other eating disorders, treatment-seeking behaviour, and concerns with eating, weight, and shape. A more recent study by Striegel-Moore et al. (2005), also comparing black and white women (who met the provisional DSM-IV criteria for Binge-Eating-Disorder), did not find differences between ethnic groups. A broad range of risk factors was assessed with the Risk Factor Interview and the Parental Bonding Instrument. No significant effects for ethnicity by diagnostic group were found.

Results by Franko, Becker, Thomas and Herzog (2007) were similar to those of Striegel-Moore et al., finding no significant differences across ethnic groups concerning the frequency of binge-eating, restrictive eating, vomiting, and amenorrhea. They did however find significant between-group differences with respect to modes of purging. Binge correlates (e.g., eating until uncomfortably full) were significantly more frequent among Caucasian than African American participants.

Other researchers believe that the risk factors for Binge-Eating-Disorder come from psychosocial elements. Comparing 52 women with Binge-Eating-Disorder with 104 women without an eating disorder, Fairburn et al. (1998) identified the following main risk factors for Binge-Eating-Disorder: negative self-evaluation, parental depression, adverse childhood experiences (sexual and physical abuse and a range of parental problems), repeated exposure to negative comments from family members about shape, weight, or eating, and pregnancy. A more recent study by Grilo and Masheb (2001) researched childhood maltreatment in 145 outpatients with Binge-Eating-Disorder. 83% of subjects in this group reported at least one type of maltreatment³, a rate 2-3 times higher than those reported in a normative sample of adult women. In a longitudinal study of adolescent girls, Stice, Presnell and Spangler (2002) found that elevated dieting, pressure to be thin, modelling of eating disturbances, appearance overvaluation, body dissatisfaction, depressive symptoms, emotional eating, body mass, and low self-esteem and social support, predicted the onset of binge eating with 92% accuracy.

From the preceding it would appear that factors such as childhood maltreatment, negative self-evaluation, parental depression, depressive symptoms and low self-esteem may play an important role in the development of Binge-Eating-Disorder, in addition to biological and genetic factors.

1.1.3 Treatment of Binge-Eating-Disorder

Binge-Eating-Disorder is treated using psychological/behavioural treatments, medication-only treatments or a combination of medication plus psychological/behavioural interventions. Psychological/behavioural interventions play a major role in the treatment of Binge-Eating-Disorder and as such personality traits need to be given full consideration.

As mentioned before, the brain plays a crucial role in Binge-Eating-Disorder (Monteleone et al., 2005). Therefore some researchers concentrated on finding pharmacotherapeutic remedies to treat Binge-Eating-Disorder. Milano et al. (2005) conducted a randomized, double-blind, placebo-

³ 59% reported emotional abuse, 36% physical abuse, 30% sexual abuse, 69% emotional and 49% physical neglect.

controlled study with sibutramine (a serotonin-norepinephrine reuptake inhibitor or SNRI) in obese patients with Binge-Eating-Disorder. After 12 weeks of treatment, binge frequency among patients given sibutramine was significantly lower than in the control group. Mathus-Vliegen (2005) found similar results in her double-blind, placebo-controlled, parallel group study. Results showed that more than 80% of the weight loss achieved during the Very-Low-Calorie-Diet phase was maintained in 70% of the sibutramine-treated patients at month 6, in 51% at month 12 and in 30% at month 18, compared to 48%, 31% and 20% in the placebo-treated patients. She concluded that weight loss achieved with a Very-Low-Calorie-Diet is more effectively maintained with sibutramine in combination with a recommended diet and exercise program than with placebo over a follow-up period of 18 months. Evaluating the available controlled treatment studies, Reas and Grilo (2008) tried to determine the utility of pharmacotherapy for Binge-Eating-Disorder. Pharmacological treatments seemed to have a clinically significant advantage over placebo concerning short-term remission from binge eating (48.7% vs. 28.5%) and for weight loss, although weight losses were not substantial. At that point in time no data existed to allow evaluation of longer-term effects of pharmacotherapy-only treatment for Binge-Eating-Disorder. Medication in combination with psychotherapy interventions showed no improvement in binge outcomes. But some specific medications, such as orlistat (a drug designed to treat obesity) or topiramate (an anticonvulsant drug), enhanced weight losses achieved with Cognitive Behavioural Therapy and Behavioural Weight Loss treatment.

Several psychological treatments of Binge-Eating-Disorder including Interpersonal Psychotherapy (IPT), Behavioural Weight Loss treatment (BWL), Cognitive-Behavioural Therapy (CBT), guided self-help based on cognitive behaviour therapy (CBTgsh) and Dialectical Behaviour Therapy (DBT), have been used successfully to reduce binge eating frequency in the short-term. However, abstinence rates of binge eating are disappointing in the long run with any one of those treatments. According to a review by de Zwaan (2001) eating disorder treatments such as CBT or IPT improve binge eating, but abstinence rates of binge eating drop to 50% after several months. Telch, Agras and Linehan (2001) analysed the effects of DBT adapted for Binge-Eating-Disorder. In comparison to women in a control group, women in the treatment group showed significant improvement on measures of binge eating and eating pathology. 89% of the women receiving DBT had stopped binge eating by the end of treatment. However, the abstinence rates dropped to 56% after 6 months, suggesting a need for further research on Dialectical Behaviour Therapy as a potential treatment for Binge-Eating-Disorder. Wilson, Wilfley, Agras and Bryson (2010) examined the effects of Interpersonal Psychotherapy, Behavioural Weight Loss treatment, and guided self-help based on Cognitive Behaviour Therapy in individuals with a BMI between 27 and 45 who met DSM-IV provisional

criteria for Binge-Eating-Disorder. Results showed that after a 2-year follow-up, both IP and guided self-help based on CBTgsh resulted in greater remission from binge eating than BWL. They concluded that IP and CBTgsh are significantly more effective than BWL to reduce binge eating after 2 years, with CBTgsh as a first-line treatment option for most patients with BED, and IPT for patients with low self-esteem and high eating disorder psychopathology.

Brownley, Berkman, Sedway, Lohr and Bulik (2007) identified 26 studies addressing treatment efficacy for Binge-Eating-Disorder. They identified three treatment groups: medication-only (Fluoxetine, Fluvoxamine, other Second-Generation Antidepressants, Tricyclic Antidepressants, Anticonvulsants, Sibutramine), behavioural interventions-only (Cognitive Behavioural Therapy, Dialectical Behavioural Therapy, Self-Help Trials, Virtual Reality for BED) and medication plus behavioural interventions. Efficacy of the treatment was defined by reduction in and abstinence from binge eating, weight loss and reductions in psychological features of Binge-Eating-Disorder. Results showed a moderate effect for medication-only treatments. Trial duration ranged from 6 to 32 weeks. Effects decreased when medication intake was ended. Results also showed a moderate effect for medication plus behavioural interventions. Trial duration ranged from 16 weeks to 9 months. Treatment effects did not persist in the long term. Finally, results showed a weak effect for self-help interventions and other interventions in the short as well as in the long term. Differential outcomes by socio-demographic factors were non-existent. Binge eating could be reduced with individual or group cognitive-behavioural therapy (CBT). CBT also improved abstinence rates for up to 4 months after treatment, but did not lead to weight loss.

These studies show that further research is needed to develop treatments that show long-term positive effects on Binge-Eating-Disorder. The treatment of Binge-Eating-Disorder is a complex process, as it often goes hand-in-hand with overvaluation of shape and weight, reflecting a low self-esteem (Goldschmidt et al., 2010; Grilo et al, 2009), increased psychosocial impairment, decrements in quality of life (Grilo et al., 2009), decrements in treatment-seeking behaviour and poorer treatment response (Masheb & Grilo, 2008). Therefore research should focus on personality, as it seems to play a rather important role in the development of and recovery from Binge-Eating-Disorder.

Summary

Binge-Eating-Disorder is classified as an “Eating Disorder Not Otherwise Specified” in DSM-IV-TR (American Psychiatric Association, 2000). Binge-Eating-Disorder is however listed and described in Appendix B “Criteria Sets and Axes Provided for Further Study” and has been investigated in a number of studies over the past 20 years. The prevalence of Binge-Eating-Disorder varies according to the population in which it has been assessed (Grucza, Przybeck & Cloninger, 2007; Hudson, Hiripi, Pope Jr. & Kessler, 2007), ranging as high as 30% in individuals seeking treatment for weight-loss (de Zwaan, 2001). Biological and genetic (Branson et al., 2003; Monteleone et al., 2005; Bulik, Sullivan & Kendler, 2003) as well as psychosocial factors (Fairburn et al., 1998; Grilo & Masheb, 2001) have been suggested as potential risk factors for Binge-Eating-Disorder. The treatment of Binge-Eating-Disorder is a complex process, and up to now, no treatments showing long-term positive effects on Binge-Eating-Disorder exist (Brownley, Berkman, Sedway, Lohr & Bulik, 2007), showing that further research is needed to develop efficient treatment.

1.2 Personality Traits

As specific personality traits may play an important role in Binge-Eating-Disorder, it is important to define the existing personality models and to elaborate some of them to understand the link between these two elements. All major dimension models of personality, including Big-Five and other models, have been reviewed and described in a monograph edited by Widiger, Simonsen, Sirovatka and Regier (2006) in preparation of the personality disorders chapter in DSM-5.

1.2.1 Personality traits of the “Big-Five”

Throughout the history of psychiatry and psychology, clinicians and researchers have tried to define personality dimensions in order to describe meaningful differences and similarities among people and to distinguish between personality traits that are normal and those that are abnormal.

Personality can be described as “an individual's characteristic patterns of thought, emotion, and behaviour, together with the psychological mechanisms-hidden or not-behind those patterns” (p.2; Funder, 2001). McAdams and Pals (2006) defined personality as an individual’s unique variation on the general evolutionary design for human nature, expressed as a developing pattern of dispositional traits, characteristic adaptations, and self-defining life narratives, complexly and differentially situated in culture and social context. As pointed out by Clark (2007), there are several dozens of personality models that have been developed over the last 20 years. As such, only a few of those models can be mentioned here. The majority of the existing models identify four or five personality factors. The Five-Factor-Model of Personality seems to reflect the bulk of personality trait variance.

The Five-Factor-Model of Personality is an empirical, comprehensive, data-driven research finding (Digman, 1990) with a long history, starting with the lexical hypothesis (Galton, as cited in Shrout and Fiske, 1995). This was put into practice by Allport and Odbert (1936) and by Cattell, Marshall and Georgiades (1957), leading to the Five-Factor-Model of personality.

The five factors (or traits) are *Openness* (O; a strong intellectual curiosity and a preference for novelty and variety), *Conscientiousness* (C; being disciplined, organized, achievement-oriented), *Extraversion* (E; higher degree of sociability, assertiveness, talkativeness), *Agreeableness* (A; being helpful, cooperative, and sympathetic towards others) and *Neuroticism* (N; degree of emotional stability, impulse control, anxiety). Each of these factors describes a range between two extremes.

The Five-Factor-Model of Personality (or the “Big Five” Factors) has in particular been put forward by Costa and McCrae (1992) to describe personality traits (see Table 4).

Table 4: The six facets of each Factor of the Five-Factor-Model

Neuroticism	Extraversion	Openness to experience	Agreeableness	Conscientiousness
1.Anxiety	1.Warmth	1.Fantasy	1.Trust	1.Competence
2.Hostility	2.Gregarious-	2.Aesthetics	2.Straight-	2.Order
3.Depression	ness	3Feelings	forwardness	3.Dutifulness
4.Self-	3.Assertiveness	4.Actions	3.Altruism	4.Achievement
consciousness	4.Activity	5.Ideas	4.Compliance	striving
5.Impulsiveness	5.Excitement	6.Values	5.Modesty	5.Self-Discipline
6.Vulnerability	Seeking		6.Tender-	6.Deliberation
to Stress	6.Positive		Mindedness	
	Emotion			

In recent years, attempts have been made to link the DSM Personality Disorders with the Five-Factor-Model (Lynam & Widinger, 2001; Rottman, Ahn, Sanislow & Kim, 2009; Widiger & Mullins-Sweatt, 2009). Results by Morey, Gunderson, Quigley and Lyons (2000) showed that by using the Five-Factor-Model of personality, the majority of the personality disorders can be differentiated in theoretically predictable ways.

To demonstrate how personality can be measured, two of those instruments will be briefly described. The *16-Personality-Factor-Questionnaire* (16PF; R.B. Cattell, 1970) is one of the oldest and best known personality inventories. Using factor analysis, Catell tried to identify the fundamental traits of human personality. The 16-PF contains 185 multiple-choice items which are written at a fifth-grade reading level. The 16 factors are: Warmth (A), Reasoning (B), Emotional Stability (C), Dominance (E), Liveliness (F), Rule-Consciousness (G), Social Boldness (H), Sensitivity (I), Vigilance (L), Abstractedness (M), Privateness (N), Apprehension (O), Openness to Change (Q1), Self-Reliance (Q2), Perfectionism (Q3) and Tension (Q4).

One of the best-known instruments is Costa and McCrae’s *NEO Personality Inventory – Revised* (*NEO-PI-R*). The NEO-PI-R is a personality inventory containing 240-items measuring different aspects of personality as defined in the Five-Factor-Model, i.e. Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience. Each factor is subdivided in 6 facets

(subordinate dimensions) (see Table 4). The NEO-PI-R is available in 2 forms: as a self-report questionnaire (Form S) and as an observer rating scale (Form R).

1.2.2 *Personality traits other than the “Big-Five”*

Cloninger (1987) proposed a seven-factor model of personality characterised by four fundamental temperaments (Novelty Seeking, Harm Avoidance, Reward Dependence and Persistence) and three character dimensions (Self-Directedness, Cooperativeness and Self-Transcendence). To assess the seven factors of his psychobiological model of personality, Cloninger developed the “Temperament and Character Inventory” (TCI), a 240-item inventory, based on the Tridimensional Personality Questionnaire (TPQ).

1.2.3 *Personality Traits as part of the Eating-Disorder-Inventory (EDI)*

The Eating-Disorder-Inventory (EDI) was developed by Garner, Olmsted and Polivy (1983) to assess the cognitive and behavioural characteristics of subjects with an eating disorder. In addition to scales that are specific to eating-disorder (Body Dissatisfaction, Drive for Thinness and Bulimia), the current version of EDI (EDI-2; 1991) also includes ten subscales (91 items) specific to the following personality traits: Inefficiency, Perfectionism, Interpersonal Distrust, Interoceptive Awareness, Maturity Fears, Asceticism, Impulse Regulation and Social Insecurity. It is one of the most widely used instruments in the field of eating disorders.

Summary

Over the past 20 years, many different models of personality have been developed (Clark, 2007). Most of these models have identified four or five personality factors or dimensions. The most widely known probably is Costa and McCrae’s (1992) model describing the five factors Openness, Conscientiousness, Extraversion, Agreeableness and Neuroticism. Among the models that depart from the Five-Factor-Model, one of the most widely known is the one by Cloninger (1987), which identifies four temperament and three character factors. In the field of eating disorders, one of the most widely used instruments is the EDI-2 which yields ten subscales including several personality dimensions.

1.3 Binge-Eating-Disorder and Personality Traits

The Big-Five and other personality traits described in *1.2 Personality Traits* have been assessed in a number of studies on eating disorders including Binge-Eating-Disorder. As Cassin and von Ranson (2005) point out, a series of studies have found an association between eating-disorders and personality traits such as Perfectionism, Obsessive-Compulsiveness, Impulsivity and Sensation Seeking. Most studies have been on personality traits in Bulimia Nervosa or Anorexia Nervosa, and not Binge-Eating-Disorder.

Assessing the Big-Five personality dimensions among participants with a lifetime history of eating disorders, Ghaderi and Scott (2000) showed that participants reported in self-report questionnaires significantly lower levels of Agreeableness, Conscientiousness and Emotional Stability, and higher level of Openness compared to people without an eating disorder. Unfortunately, the extent to which Binge-Eating-Disorder is associated with specific personality traits remains still unclear. These findings nonetheless should be used as guidelines to identify possible personality traits proper to Binge-Eating-Disorder.

Amianto et al. (2011) compared subjects meeting full criteria for Binge-Eating-Disorder and subjects with only sub-threshold-Binge-Eating-Disorder (s-BED), using the Hypomania Checklist (HCL-32), the Beck Depression Inventory (BDI) and the Temperament and Character Inventory (TCI). Results showed that patients meeting full criteria for Binge-Eating-Disorder were more likely to be female and showed higher HCL-32 scores and lower scores on Self-directedness and Cooperativeness compared to s-BED patients. Meeting full criteria for Binge-Eating-Disorder was associated with lower Cooperativeness and higher Hypomania scores.

Most of the seven studies that had to be excluded from the present meta-analyses and all of the nine studies that were included in the meta-analyses of the present study (see below under 3.5, Table 6) have found an association between Binge-Eating-Disorder and one or several personality traits. The results of two of the nine studies are given in more details below.

Peterson et al. (2010) examined differences in personality traits among individuals with Bulimia Nervosa, Binge-Eating-Disorder, non-binge eating obesity, and a normal-weight comparison group. Results showed that patients with Binge-Eating-Disorder scored lower on well-being and higher on Harm Avoidance than the normal-weight comparison group. In Binge-Eating-Disorder (and Bulimia Nervosa), subjects scored lower than the normal-weight group on positive emotionality. When personality dimensions were re-analysed using depression as a covariate, Harm Avoidance remained higher in the Binge-Eating-Disorder than the normal-weight comparison group.

Davis et al. (2008) assessed 94 persons with Binge-Eating-Disorder, 111 non-binging normal-weight persons and 54 non-binging obese persons on several personality traits and eating behaviours. Interestingly, results showed no differences on the personality traits between Binge-Eating-Disorder individuals and obese controls. Both groups were more reward sensitive and had greater anxiousness, impulsivity, and addictive personality traits than the normal weight control group. Although the findings provided no evidence of a psychological identity unique to obese adults with Binge-Eating-Disorder, their eating behaviours was markedly hedonically driven (i.e., more responsive to factors external to physiological needs).

The focus of the present meta-analyses is on Impulsivity, Perfectionism, Ineffectiveness, Harm Avoidance, Reward Dependence and Novelty Seeking, as these are the personality traits that have been described most often in studies focussing on Binge-Eating-Disorder. The different personality traits and facets have been defined in numerous ways, and not all instruments measuring personality use the same definition. Therefore the following paragraphs give a small overview of different definitions.

1.3.1 *Impulsivity*

One of the most prominent definitions of Impulsivity is by Moeller, Barratt, Dougherty, Schmitz and Swann (2001): Impulsivity is “a predisposition toward rapid, unplanned reactions to internal or external stimuli without regard to the negative consequences of these reactions to the impulsive individual or to others” (p. 1784). It further can be described as the tendency to act on cravings and urges rather than reining them in and delaying gratification. The Barratt Impulsiveness Scale (BIS; Patton, Stanford & Barratt, 1995) is the most widely used self-report measure of impulsive personality traits (Stanford, Mathias, Dougherty, Lake, Anderson & Patton, 2009). It was designed to assess the personality/behavioural construct of impulsiveness. It divides Impulsivity into Attentional Impulsiveness, Motor Impulsiveness and Non-planning Impulsiveness. In the Eating-Disorder-Inventory – 2 (EDI-2; Garner, 1991), the subscale Impulse Regulation measures the ability to regulate impulsive behaviour, especially the binge behaviour.

1.3.2 *Perfectionism*

Perfectionism is described as “the practice of demanding of oneself or others a higher quality of performance than is required by the situation” (English & English, 1958, cited in Bastiani, Rao, Weltzin & Haye, 1995) and “setting unrealistic standards and striving to attain those standards,

selective attention to and over-generalization of failure, stringent self-evaluations, and a tendency to engage in all-or-none thinking where by total success or total failure exist as outcomes” (Hewitt & Flett, 1991, cited in Bastiani, Rao, Weltzin & Haye, 1995). Furthermore, perfectionism is an extreme manifestation of conscientiousness (Cattell & Mead, 2008). The instruments used to identify perfectionism suggest a uni-dimensional, two-dimensional or even three-dimensional structure of perfectionism (Lampard, Byrne, McLean & Fursland, 2012). In the EDI and EDI-2, perfectionism is described as not being satisfied with anything less than perfect.

1.3.3 Ineffectiveness

In the EDI-2, Ineffectiveness relates to feelings of general inadequacy, insecurity, worthlessness and a feeling of having no control over one’s life. As McLaughlin, Karp and Herzog (1985) point out, patients with Anorexia Nervosa and Bulimia Nervosa show a diminished capacity for autonomous functioning. Stronger feelings of ineffectiveness could also be shown in people with Binge-Eating-Disorder (de Zwaan et al., 1993). Subjects who score high on Ineffectiveness have a low opinion about themselves, they feel inferior to others, they feel alone in the world and they wish they were someone else.

1.3.4 Harm Avoidance

Cloninger (1987) described Harm Avoidance as a heritable tendency to learn to avoid punishment. Harm Avoidance can be characterized by worrying excessively, being pessimistic, shy, fearful of uncertainty, doubtful, and tiring easily (Wilson, Buchman, Arnold, Shah, Tang & Bennett, 2006). One of the instruments that received the most empirical attention concerning Harm Avoidance is the Temperament and Character Inventory (TCI; Cloninger, Przybeck, Svrakic & Wetzel, 1994). In the TCI, Harm Avoidance (35 items) is one of four temperament dimensions. It is split into four subscales: Anticipatory Worry and Pessimism (vs. Uninhibited Optimism), Fear of uncertainty (vs. Confidence), Shyness with Strangers (vs. Gregariousness) and Fatigability and Asthenia (vs. Rigor). Harm Avoidance also can be used as a measure of anxiety proneness and reduced risk-taking propensity (Cloninger et al., 1998). The Tridimensional Personality Questionnaire (TPQ; Cloninger, 1987a) is a somewhat older version of the TCI. It describes Harm Avoidance as the tendency toward an inhibitory response to signals of aversive stimuli that leads to avoidance of punishment and non-reward (Hansenne, Pitchot, Moreno, Reggers, Machurot & Ansseau, 1997). In the Multidimensional

Personality Questionnaire (Tellegan, 2000), Harm Avoidance is akin to the reverse of sensation seeking.

1.3.5 Reward Dependence

The personality trait Reward Dependence is one of the personality traits measured by the TCI. Cloninger (1994) described it as the tendency to respond markedly to signals of reward (especially to verbal signals of social approval or social support). People with a high score on Reward Dependence show a tendency for sentimentality, social sensitivity, attachment, and dependence on approval by others and are tender-hearted, sensitive, socially dependent and sociable. They try to keep up and pursue those behaviours which were previously associated with such rewards. People with a low score on Reward Dependence can be described as tough-minded, cold, socially insensitive, irresolute, and indifferent if alone.

1.3.6 Novelty Seeking

Cloninger (1987) described the personality trait Novelty Seeking as the “tendency toward intense exhilaration or excitement in response to novel stimuli or cues for potential rewards or potential relief of punishment” (pp. 574-575). People with a high score on Novelty Seeking can be described as quick-tempered, curious, easily bored, impulsive, extravagant and disorderly. In contrast, people with a low score on Novelty Seeking can be described as slow tempered, un-inquiring, stoical, reflective, frugal, reserved, tolerant of monotony and orderly.

Summary

A considerable number of studies have found an association between eating disorders and personality traits (Cassin & von Ranson, 2005). Most of those studies have been however on personality traits in Bulimia Nervosa or Anorexia Nervosa, and not on Binge-Eating-Disorder. Studies which did analyse personality traits in Binge-Eating-Disorder suggest that specific personality traits may be particularly pronounced in Binge-Eating-Disorder, most noteworthy Impulsivity, Perfectionism, Ineffectiveness, Harm Avoidance, Reward Dependence and Novelty Seeking (Ghaderi & Scott, 2000; Davis et al., 2008; Peterson et al., 2010; Amianto et al., 2011).

2 Problem definition and Hypotheses

Binge-Eating-Disorder is common in patients presenting with obesity or pre-obesity. The origin of Binge-Eating-Disorder however has remained elusive, including its association with personality traits. Furthermore, the treatment of Binge-Eating-Disorder is difficult and not always efficient. Several studies (see above) suggest that specific personality traits may be relevant for a better understanding of the aetiology and maintenance as well as for a better treatment of Binge-Eating-Disorder. As such, identifying specific personality dimensions that are associated with Binge-Eating-Disorder would be important both from a theoretical, scientific point of view and from a practical, therapeutic perspective. Confirming an association between the two would be of major importance to those working in the field of eating disorders as well as in the field of obesity.

Up to now, the question of what specific personality traits underlie Binge-Eating-Disorder has only been assessed in primary studies. This represents a first approach to better understand the association between specific personality traits and Binge-Eating-Disorder. Considering the relative high number of studies addressing Binge-Eating-Disorder and personality traits, however it is not always easy to keep track of the association between these variables, knowing that the results can vary from one study to the other. A meta-analysis would allow the results of primary research studies to be quantitatively integrated. To this author's knowledge, no attempt has as yet been made in this direction.

The objective of the systematic review and meta-analyses is to investigate the association between Binge-Eating-Disorder and personality traits in patients presenting with obesity or pre-obesity (overweight) and by summarizing and critically examining studies investigating possible connections between those elements.

The present review of the literature suggests that there is an association between Binge-Eating-Disorder and pre-obesity/obesity on the one hand and between Binge-Eating-Disorder and personality on the other.

Studies have shown that although Binge-Eating-Disorder is not limited to obese or pre-obese, individuals who seek treatment for weight control present with Binge-Eating-Disorder more often than people who are not obese/pre-obese (de Zwaan, 2001). Furthermore, a positive correlation between the severity of Binge-Eating-Disorder and the degree of obesity has been found (Bruce & Agras, 1991). The literature also suggests an association between Binge-Eating-Disorder and specific personality factors, as was described in *1.3 Binge-Eating-Disorder and Personality Traits*. This has led to the following hypotheses:

Hypothesis 1: Pre-obese or obese people with Binge-Eating-Disorder show different levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than normal-weight people without Binge-Eating-Disorder; more precisely, pre-obese or obese people with Binge-Eating-Disorder show **higher** levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than normal-weight people without Binge-Eating-Disorder. It is expected that the comparison between pre-obese or obese people with Binge-Eating-Disorder and normal-weight people without Binge-Eating-Disorder will show a strong effect size for each one of the six personality traits under discussion.

Hypothesis 2: Pre-obese or obese people with Binge-Eating-Disorder show different levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than pre-obese or obese people without Binge-Eating-Disorder; more precisely, pre-obese or obese people with Binge-Eating-Disorder show **higher** levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than pre-obese or obese people without Binge-Eating-Disorder. It is expected that the comparison between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder will show a strong effect size for each one of the six personality traits under discussion.

Hypothesis 3: Pre-obese or obese people without Binge-Eating-Disorder show similar levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than normal-weight people without Binge-Eating-Disorder. It is expected that the comparison between pre-obese or obese people without Binge-Eating-Disorder and normal-weight people without Binge-Eating-Disorder will show a small effect size or an effect size close to null for each one of the six personality traits under discussion.

3 Methods

The goal of this study is to summarize the research that has examined Binge-Eating-Disorder and different personality traits and to use meta-analysis to draw conclusions about the relationship between personality and Binge-Eating-Disorder. The general guidelines of the PRISMA-Statement for systematic review and meta-analyses were followed.

3.1 Material and Methods

The Cochrane Collaboration (www.cochrane.org) defines systematic reviews as “a high-level overview of primary research on a particular research question that tries to identify, select, synthesize and appraise all high quality research evidence relevant to that question in order to answer it”. Meta-analyses are defined as “the use of statistical techniques in a systematic review to integrate the results of included studies”. Both are essential to summarize evidence accurately and reliably. To ensure the clarity and transparency of systematic reviews and meta-analyses, guidelines were established.

This review followed the general PRISMA-Statement (Preferred Reporting Items for Systematic reviews and Meta-Analysis) guidelines for conducting and reporting systematic reviews (Moher, Liberati, Tetzlaff & Altman, 2009; Liberati et al., 2009). The PRISMA-Statement is an evidence-based minimum set of items (27-item checklist) for reporting in systematic reviews and meta-analyses plus a four-phase flow diagram. The main topics of the checklist are Title, Abstract, Methods, Results and Discussion. The aim of the PRISMA-Statement is to help authors to improve the reporting of systematic reviews and meta-analyses.

3.2 Data Sources and Literature search

Data collection was conducted up to March 2012 by searching five electronic databases to identify eligible studies concerning Binge-Eating-Disorder and personality traits, including *PsycINFO*, *PsycARTICLES*, *Scopus*, *PubMed* and the *ISI Web of Science*. Journals were searched from 1994 on (i.e. the year in which Binge-Eating-Disorder was added as a provisional category in Appendix B of DSM-IV). According to a prior decision, only published studies and primary sources were considered (see point 5.5 *Limitations*).

The search strategy included different combinations of the main reference terms (see *Appendix A: Keyword-Combinations*): Binge Eating, Binge-Eating-Disorder, bingeing, binge, Personality Trait(s), Five-Factor-Model, Big-Five, Big-5, Extraversion, Openness, Conscientiousness, Neuroticism, Agreeableness, NEO-PI-R, 16PF.

3.3 Criteria for including studies in the Meta-Analyses

To be included into the meta-analyses, studies were required to be in English, German or French. In order to obtain externally valid results, they had to rely on the definition of Binge-Eating-Disorder as provided in Appendix B of DSM-IV. To be relevant for this study they had to assess both Binge-Eating-Disorder and personality traits. To be considered for these meta-analyses, studies had to include at least one group of subjects with Binge-Eating-Disorder, associated with pre-obesity, obesity or normal-weight.

Studies that were in other languages than the ones spoken by the author, meaning other than English, German or French, were excluded from the meta-analyses. Owing to issues of validity and reliability, simple case-studies and studies with a sample size smaller than $n=3$ were also excluded from the meta-analyses. Subjects under the age of 18 were excluded from the meta-analyses, because this study relies on BMI-values to differentiate between people with normal-weight and people with pre-obesity or obesity. In comparison to adults, BMI-values are however used differently for children and teenagers in that they are age-and sex-specific. As such, it would not have been possible to analyse results for adults together with results for children/adolescents. Studies that were published prior to 1994 (i.e. prior to the addition of Binge-Eating-Disorder as a provisional category in Appendix B of DSM-IV), or that assessed binge-eating only in connection with Bulimia Nervosa (Binge-Eating-Disorder in connection with Bulimia Nervosa would not be considered as a disorder on its own) were also excluded from the meta-analyses.

3.4 Data extraction

Data from the reviewed studies were extracted using a data extraction sheet (see *Appendix B: Coding Scheme for Data Extraction from Primary Sources*). The data extraction sheet listed the following categories designed to describe and compare the studies: name of author(s), publication year, number of cases (People with pre-obesity or obesity and with Binge-Eating-Disorder/ People with normal-weight and without Binge-Eating-Disorder / People with pre-obesity or obesity and

without Binge-Eating-Disorder), age (mean and range), gender, BMI (mean and range), eating disorder screening tool used, personality traits assessed, personality screening tool used, country, results (mean/confidence-interval/SD/test statistics). An additional column was added to record potential comments on different studies.

3.5 Study Assessment Procedure and Selection of Studies for the Meta-Analyses

A total of 364 articles were obtained by searching five data bases: PubMed, 32 articles; Scopus, 117 articles; PsycINFO, 90 articles; PsycARTICLES, 7 articles; and ISI Web of Science, 118 articles. For better management, the studies were entered into the reference management program Citavi.

In total, 170 articles remained after deleting all duplicates: 49 articles had 2 duplicates; 48 articles had 3 duplicates; 10 articles had 4 duplicates; 1 article had 5 duplicates, (meaning that this article was found in all 5 electronic databases) and 9 more duplicates were identified using the abstracts.

These 170 were then screened independently by the author and independently by an expert in the field to assess the previous criteria. After the first screening, 79 articles were identified both excluded, 26 both included, 52 articles both were not sure yet, and 13 reviews. The final decision about which articles to include and which to exclude from the study was made by the author alone (see point 5.5 *Limitations*). A detailed indication of which articles and data were excluded for what reason can be found in *Appendix C: Studies and Data Excluded from Meta-Analyses*.

The study assessment procedure yielded 12 studies to be considered. Through hand searching, four more relevant articles were found. Unfortunately, due to missing data, seven articles had to be excluded (see Table 5).

Surprisingly, the literature search did not yield any studies involving the NEO-PI-R or the Big-Five meeting the inclusion criteria that had been defined for the present study. It did however find studies based upon other instruments (EDI, EDI-2, TCI, SCID, TPQ, MPQ) yielding a number of other personality traits. Owing to the fact that it would not have been possible to consider all those personality traits, the author decided to focus on those traits that had been assessed in at least three studies. These were: Impulsivity, Perfectionism, Ineffectiveness, Harm Avoidance, Reward Dependence and Novelty Seeking.

Table 5: Articles excluded due to missing data

1. Benjamin, L., & Wulfert, E. (2005). Dispositional correlates of addictive behaviors in college women: Binge eating and heavy drinking. <i>EATING BEHAVIORS</i> , 6(3), 197–209.	no response from author
2. Bulik, C. M., Sullivan, P. F., & Kendler, K. S. (2002). Medical and psychiatric morbidity in obese women with and without binge eating. <i>INTERNATIONAL JOURNAL OF EATING DISORDERS</i> , 32(1), 72–78.	data is not available
3. Connolly, A. M., Rieger, E., & Caterson, I. (2007). Binge eating tendencies and anger coping: Investigating the confound of trait neuroticism in a non-clinical sample. <i>EUROPEAN EATING DISORDERS REVIEW</i> , 15(6), 479–486.	no possibility to contact author
4. Mackinnon, S. P., Sherry, S. B., Graham, A. R., Stewart, S. H., Sherry, D. L., Allen, S. L., ... (2011). Reformulating and testing the perfectionism model of binge eating among undergraduate women: A short-term, three-wave longitudinal study. <i>JOURNAL OF COUNSELING PSYCHOLOGY</i> , 58(4), 630–646.	no response from author
5. Pratt, E.M., Telch, C.F., Labouvie, E.W., Wilson, G.T., & Agras, W.S. (2001). Perfectionism in Women with Binge Eating Disorder. <i>International Journal of Eating Disorders</i> , 29, 177–186	data is not available
6. Rush, C. C., Becker, S. J., & Curry, J. F. (2009). Personality Factors and Styles Among College Students Who Binge Eat and Drink. <i>PSYCHOLOGY OF ADDICTIVE BEHAVIORS</i> , 23(1), 140–145.	no possibility to contact author
7. Womble, L. G., Williamson, D. A., Martin, C. K., Zucker, N. L., Thaw, J. M., Netemeyer, R., ... (2001). Psychosocial variables associated with binge eating in obese males and females. <i>The International journal of eating disorders</i> , 30(2), 217–221.	no response from author

The final pool included nine empirical studies meeting the inclusion criteria. All samples together combined 1979 participants (1525 women, 454 men). The age of participants ranged from 18 to 64 years. The meta-analyses focussed on the personality traits Impulsivity, Ineffectiveness, Perfectionism, Harm Avoidance, Reward Dependence and Novelty Seeking. The characteristics of the nine studies are shown in Table 6.

Table 6: Detailed Characteristics of the nine studies included in the meta-analyses

Study	Year	Country	Number of all cases	Mean Age	Gender	Mean BMI (Obese)
Adami et al.	1996	Italy	63	37	48 women, 15 men	46.9
Molinari et al.	1997	Italy	45	34.5	only women	37.8
Fassino et al.	2002	Italy	200	20-60	only women	38.32
Fassino et al.	2003	Italy	196	34.1	only women	37.13
Nasser et al.	2004	USA	33	30.5	only women	35.1
Striegel-Moore et al.	2005	USA	214	30.61	only women	35.09
Gruza et al.	2007	USA	903	44	497 women, 406 men	30.95
Davis et al.	2008	Canada	164	34.9	131 women, 33 men	37.1
Peterson et al.	2010	USA	161	36.05	only women	35.4

3.6 Data analysis and synthesis

The data was analysed using the software Comprehensive Meta-Analysis (CMA) version 2, a programme developed by a team of experts in the US and UK (BioStat, Inc, Enlewood, NJ.). The analysis was based on the nine studies that meet the inclusion criteria set out prior to the systematic review (see Table 6).

In the meta-analyses, the following groups were compared on the mean scores of six personality traits: Impulsivity, Ineffectiveness, Perfectionism, Harm Avoidance, Reward Dependence and Novelty Seeking:

- (1) pre-obese or obese people with Binge-Eating-Disorder versus normal-weight people without Binge-Eating-Disorder (“BED vs. Normal-weight”),
- (2) pre-obese or obese people with Binge-Eating-Disorder versus pre-obese or obese people without Binge-Eating-Disorder (“BED vs. Pre-Obese/Obese”) and
- (3) pre-obese or obese people without Binge-Eating-Disorder versus normal-weight people without Binge-Eating-Disorder (“Pre-Obese/Obese vs. Normal-weight”).

In the group “BED” all the people were pre-obese or obese, meaning they had a BMI over 30, and all were positive for Binge-Eating-Disorder. In the group “Normal-weight”, people had a normal weight, meaning a BMI between 19 and 25, and they had no eating or other mental disorders. In the group “Obese”, all the people were pre-obese or obese, meaning that they had a BMI over 30, and had no eating or other mental disorders.

N.B. No study was identified in which Binge-Eating-Disorder was associated with normal-weight.

All personality trait measurements are from validated personality assessment instruments.

Overall standardized mean differences were obtained for three group comparisons: “BED vs. Normal-weight”, “BED vs. Pre-Obese/Obese” and “Pre-Obese/Obese vs. Normal-weight”. Using the data from the nine studies of Table 6, it was possible to conduct 52 specific group comparisons on various personality traits that were contained in the studies. They are listed in Table 7 along with the number of cases for each comparison (N), mean effect size (d), standard error (SE), and the instrument used.

Table 7: Study Characteristics of the 52 specific group comparisons

Study	N	<i>d</i>	SE	Instrument	Comparison Groups
Impulsivity					
Fassino et al. (2003) (1)	196	1,441	0,194	EDI-2	BED vs. Normal-weight
Fassino et al. (2003) (2)	196	0,683	0,203	EDI-2	BED vs. Pre-Obese/Obese
Fassino et al. (2003) (3)	196	0,779	0,179	EDI-2	Pre-Obese/Obese vs. Normal-weight
Nasser et al. (2004)	33	0,812	0,444	BIS	BED vs. Pre-Obese/Obese
Davis et al. (2008) (1)	164	0,679	0,195	BIS	BED vs. Normal-weight
Davis et al. (2008) (2)	164	-0,062	0,195	BIS	BED vs. Pre-Obese/Obese
Davis et al. (2008) (3)	164	0,772	0,197	BIS	Pre-Obese/Obese vs. Normal Weight
Ineffectiveness					
Adami et al. (1996) (1)	63	0,117	0,230	EDI	BED vs. Normal-weight
Adami et al. (1996) (2)	63	-0,308	0,256	EDI	BED vs. Pre-Obese/Obese
Adami et al. (1996) (3)	63	0,534	0,212	EDI	Pre-Obese/Obese vs. Normal-weight
Moliniari et al. (1997)	45	0,822	0,380	EDI	BED vs. Pre-Obese/Obese
Fassino (2003) (1)	196	2,111	0,214	EDI-2	BED vs. Normal-weight
Fassino (2003) (2)	196	0,976	0,208	EDI-2	BED vs. Pre-Obese/Obese
Fassino (2003) (3)	196	0,976	0,182	EDI-2	Pre-Obese/Obese vs. Normal-weight
Perfectionism					
Adami et al. (1996) (1)	63	0,159	0,230	EDI	BED vs. Normal-weight
Adami et al. (1996) (2)	63	0,000	0,255	EDI	BED vs. Pre-Obese/Obese
Adami et al. (1996) (3)	63	0,288	0,210	EDI	Pre-Obese/Obese vs. Normal-weight
Molinari et al. (1997)	45	0,789	0,379	EDI	BED vs. Pre-Obese/Obese
Fassino et al. (2003) (1)	196	0,560	0,177	EDI-2	BED vs. Normal-weight
Fassino et al. (2003) (2)	196	0,639	0,202	EDI-2	BED vs. Pre-Obese/Obese
Fassino et al. (2003) (3)	196	-0,108	0,173	EDI-2	Pre-Obese/Obese vs. Normal-weight
Striegel-Moore et al. (2005)	214	0,706	0,122	SCID	BED vs. Normal-weight
Harm Avoidance					
Fassino et al. (2002) (1)	200	0,642	0,176	TCI	BED vs. Normal-weight
Fassino et al. (2002) (2)	200	0,312	0,184	TCI	BED vs. Pre-Obese/Obese
Fassino et al. (2002) (3)	200	0,290	0,171	TCI	Pre-Obese/Obese vs. Normal Weight
Grucza et al. (2007) (1)	903	0,692	0,137	TCI	BED vs. Normal-weight
Grucza et al. (2007) (2)	903	0,380	0,145	TCI	BED vs. Pre-Obese/Obese
Grucza et al. (2007) (3)	903	0,277	0,076	TCI	Pre-Obese/Obese vs. Normal Weight
Davis et al. (2008) (1)	164	0,787	0,196	TPQ	BED vs. Normal-weight
Davis et al. (2008) (2)	164	0,064	0,195	TPQ	BED vs. Pre-Obese/Obese
Davis et al. (2008) (3)	164	0,695	0,196	TPQ	Pre-Obese/Obese vs. Normal Weight

Peterson et al. (2010) (1)	161	0,715	0,183	MPQ	BED vs. Normal-weight
Peterson et al. (2010) (2)	161	0,441	0,230	MPQ	BED vs. Pre-Obese/Obese
Peterson et al. (2010) (3)	161	0,291	0,216	MPQ	Pre-Obese/Obese vs. Normal Weight

Reward Dependence

Fassino et al. (2002) (1)	200	-0.192	0.172	TCI	BED vs. Normal-weight
Fassino et al. (2002) (2)	200	-0.067	0.183	TCI	BED vs. Pre-Obese/Obese
Fassino et al. (2002) (3)	200	-0.124	0.170	TCI	Pre-Obese/Obese vs. Normal Weight
Grucza et al. (2007) (1)	903	-0.091	0.135	TCI	BED vs. Normal-weight
Grucza et al. (2007) (2)	903	-0.108	0.144	TCI	BED vs. Pre-Obese/Obese
Grucza et al. (2007) (3)	903	0.020	0.075	TCI	Pre-Obese/Obese vs. Normal Weight
Davis et al. (2008) (1)	164	0.149	0.190	TPQ	BED vs. Normal-weight
Davis et al. (2008) (2)	164	0.346	0.197	TPQ	BED vs. Pre-Obese/Obese
Davis et al. (2008) (3)	164	-0.188	0.191	TPQ	Pre-Obese/Obese vs. Normal Weight

Novelty Seeking

Fassino et al. (2002) (1)	200	0.629	0.176	TCI	BED vs. Normal-weight
Fassino et al. (2002) (2)	200	0.133	0.183	TCI	BED vs. Pre-Obese/Obese
Fassino et al. (2002) (3)	200	0.497	0.173	TCI	Pre-Obese/Obese vs. Normal Weight
Grucza et al. (2007) (1)	903	0.451	0.136	TCI	BED vs. Normal-weight
Grucza et al. (2007) (2)	903	0.428	0.145	TCI	BED vs. Pre-Obese/Obese
Grucza et al. (2007) (3)	903	0.041	0.075	TCI	Pre-Obese/Obese vs. Normal Weight
Davis et al. (2008) (1)	164	0.321	0.190	TPQ	BED vs. Normal-weight
Davis et al. (2008) (2)	164	-0.293	0.196	TPQ	BED vs. Pre-Obese/Obese
Davis et al. (2008) (3)	164	0.668	0.195	TPQ	Pre-Obese/Obese vs. Normal Weight

The effect size d is “a value which reflects the magnitude of the treatment effect or (more generally), the strength of a relationship between two variables” (p.3; Borenstein, Hedges, Higgins & Rothstein, 2009). Cohen (1977) defines a small effect size as $d = 0.2$, a medium effect size as $d = 0.5$ and a large effect size as $d = 0.8$.

There are two different approaches to decide which statistical model should be applied to the meta-analytic database, an empirical and a theoretical one.

In the empirical approach, heterogeneity is assessed to decide which statistical model should be applied to the meta-analytic database. The Cochrane's Q statistic (with $df = \text{number of studies} - 1$) and the I^2 statistic were used to assess whether there is a true between-study effect heterogeneity. The Q statistic tests the null hypothesis that all studies share a common effect size

(homogeneity). If the result is significant, this indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effects-Model instead of a Fixed-Effect-Model. Under the Fixed-Effect-Model it would be assumed that all studies in the meta-analysis share a common effect size whereas under the Random-Effects-Model it would be assumed that the true effect could vary from one study to another (Borenstein, Hedges, Higgins & Rothstein, 2009). The I^2 statistic is a descriptive statistic which can be viewed as a measure of inconsistency across the findings of the studies. I^2 has a range of 0-100%. This means that the higher the percentage, the higher the inconsistency. Therefore a value of 25% might be considered as low inconsistency, a value of 50% as moderate inconsistency and a value of 75% as high inconsistency.

The other approach is the theoretical one. In this meta-analyses, it would be highly improbable that the true effect size is the same in all studies. As shown in Tables 6 and 7, the participants differed in age, gender, BMI and nationality. In addition, different instruments were used to assess the personality traits. Therefore Random-Effects-Models were calculated for all comparisons as they assume that the true effect could vary from one study to another.

Empirical values were nevertheless calculated for analysis of heterogeneity to identify possible outliers.

It is important to account for the possibility that some studies have been missed because “studies that report relatively high effect sizes are more likely to be published than studies that report lower effect sizes” (p. 277; Borenstein, Hedges, Higgins & Rothstein, 2009). Therefore the retrieved and included samples could be a biased sample of all relevant studies. This problem is generally known as the publication bias. Several tests were performed in order to control the resulting overall effect sizes for publication bias.

First, a visual inspection of the funnel plot was conducted. This was only possible if there were at least three studies, as the program CMA can process funnel plots only if there are three or more studies. If the studies are distributed symmetrically about the mean effect size, there is no publication bias, as the sampling error is random. If there is a publication bias, the studies are distributed asymmetrically (Borenstein, Hedges, Higgins & Rothstein, 2009). Since the visual inspection of the funnel plot is largely subjective, two more tests were conducted to identify a possible publication bias.

Second, Rosenthal’s Fail-Safe N was conducted to show whether or not the observed overall effect is robust. The Rosenthal’s Fail-Safe N gives the number of studies showing null-results that would have to be added to effect-size calculation to reach non-significance in the overall effect.

Third, the Duval-Tweedie trim-and-fill analysis (Cooper, Hedges & Valentine, 2009) was conducted. It yields an unbiased estimate of the effect size. It uses an iterative procedure to remove the most extreme small studies from the positive side of the funnel plot and then re-computes the effect size at each iteration until the funnel plot is symmetric about the new effect size (Borenstein, Hedges, Higgins & Rothstein, 2009).

Additionally, sensitivity analyses were performed to assess influence of single studies on overall effect sizes. The effect sizes of studies are combined while one study is removed in each turn. This allows determining the influence of single studies that have unusual high or unusual low effect sizes and high numerical study weights (Borenstein, Hedges, Higgins & Rothstein, 2009). Again, there needed to be at least three studies for the sensitivity analysis to be relevant.

4 Results

The meta-analyses focused on comparing obese individuals with Binge-Eating-Disorder versus pre-obese or obese individuals without Binge-Eating-Disorder, pre-obese or obese individuals with Binge-Eating-Disorder versus individuals with normal-weight and pre-obese or obese individuals without Binge-Eating-Disorder versus individuals with normal-weight on the personality traits Impulsivity, Ineffectiveness, Perfectionism, Harm Avoidance, Reward Dependence and Novelty Seeking using data deriving from the nine studies described in Table 6.

As mentioned before (see 3.6 *Data analysis and synthesis*), Random-Effects-Models were calculated for all comparisons.

4.1 Combined Effect Sizes for Binge-Eating-Disorder and Impulsivity

The meta-analyses were performed on three studies involving 393 subjects. Two of these studies had fairly similar high numbers of subjects (196 respectively 164) while the third one was limited to only 30 subjects. Mean BMI for the obese subjects was 36.

For the personality trait Impulsivity, an overall effect size was calculated for the three pairs of comparison (3 studies). The pair of comparison “BED vs. Normal-Weight” (2 study effects) yielded an effect size of $d = 1.060$ (95 % CI [0.31, 1.81]), which is a very strong effect (Cohen, 1977). This means that there is a highly significant difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people with Binge-Eating-Disorder show much higher scores for Impulsivity than people with normal-weight. The pair of comparison “BED vs. Pre-obese/Obese” (3 study effects) yielded an effect size of $d = 0.424$ (95 % CI [-0.16, 1.01]), which is a medium effect (Cohen, 1977). This means that there is a significant, although not very strong, difference between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that pre-obese or obese people with Binge-Eating-Disorder show scores for Impulsivity that are higher, although not very much higher, than the scores of pre-obese or obese people without Binge-Eating-Disorder. The pair of comparison “Pre-obese/Obese vs. Normal-Weight” (2 study effects) yielded an effect size $d = 0.776$ (95 % CI [0.52, 1.04]), which is a strong effect (Cohen, 1977). This means that there is a highly significant difference between pre-obese or obese people without Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people without Binge-

Eating-Disorder show much higher scores for Impulsivity than people with normal-weight. The Forest-Plots are shown in Figure 1 to 3.

Figure 1: Forest-Plot (Random-Effects-Model)

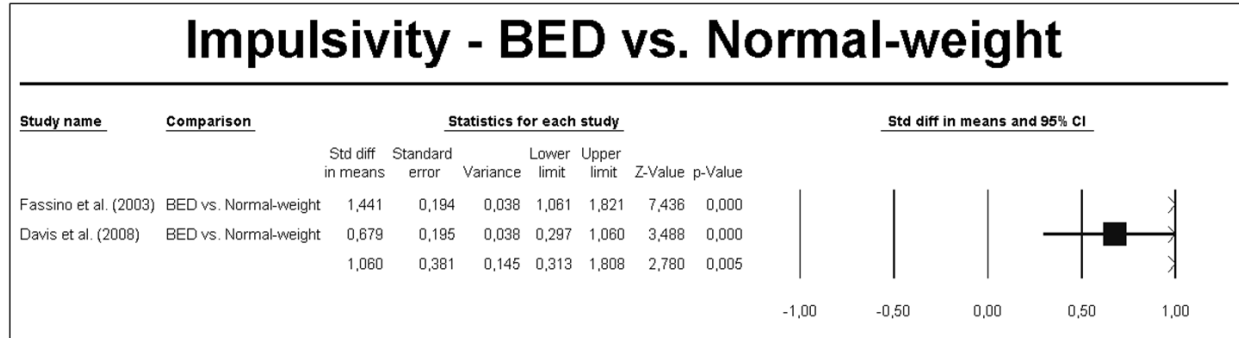
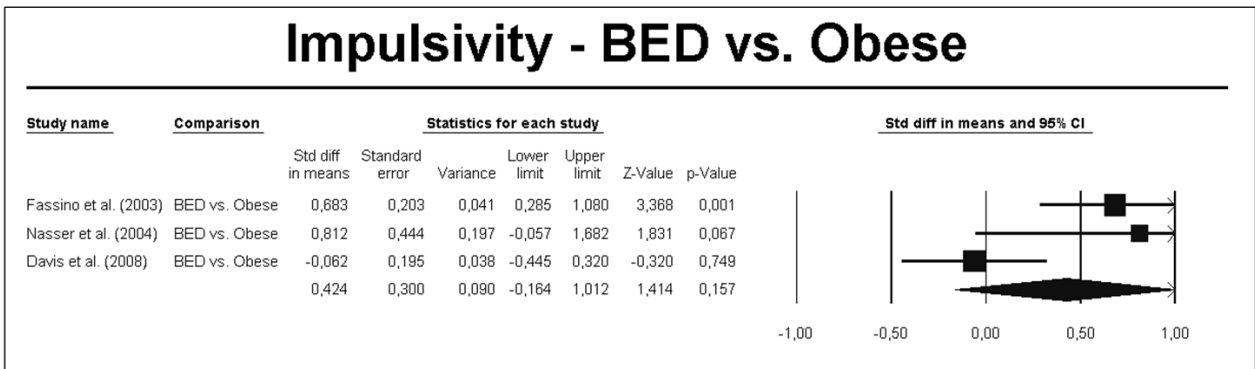
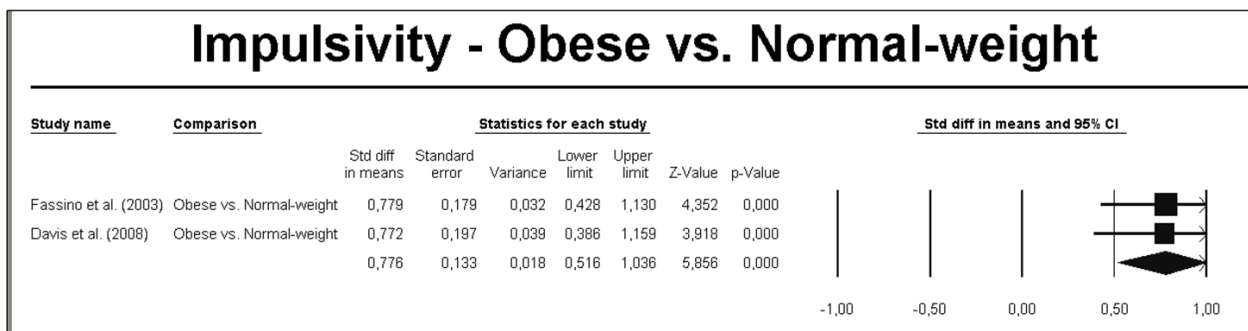


Figure 2: Forest-Plot (Random-Effects-Model)



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as "Obese" in this figure

Figure 3: Forest-Plot (Random-Effects-Model)



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as "Obese" in this figure

4.1.1 Analysis of Heterogeneity - BED vs. Normal-weight

For the comparison “BED vs. Normal-weight”, two contrasted study effects with significantly different effect sizes were included for data analysis. The test of Effect Heterogeneity across studies for Impulsivity (BED vs. Normal-weight) can be seen in Table 8.

Table 8: Test of Effect Heterogeneity across studies for Impulsivity (BED vs. Normal-weight)

	Q	df (Q)	p	I ²
BED vs. Normal Weight	7.710	1	0.005*	87.030
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				
<i>* p ≤ 0.01</i>				

The Q statistic, which tests the null hypothesis that all studies share a common effect size (homogeneity), is significant ($p = 0.005$). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effects-Model instead of a Fixed-Effect-Model. The I² statistic is a descriptive statistic (range: 0-100%) which can be viewed as a measure of inconsistency across the findings of the studies. This means that the higher the percentage, the higher the inconsistency. The value of 87.03% is indicative of high inconsistency.

No sensitivity analysis was calculated for this comparison as there were only 2 studies.

No funnel plot was drawn for this comparison as there were only 2 studies.

4.1.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

For the comparison “BED vs. Pre-Obese/Obese” on Impulsivity, one study found a medium effect, one study a strong effect and the remaining study found an effect close to null ($d = -0.062$) (Cohen, 1977). . The test of Effect Heterogeneity across studies for Impulsivity (BED vs. Pre-Obese/Obese) can be seen in Table 9.

Table 9: Test of Effect Heterogeneity across studies for Impulsivity (BED vs. Pre-Obese/Obese)

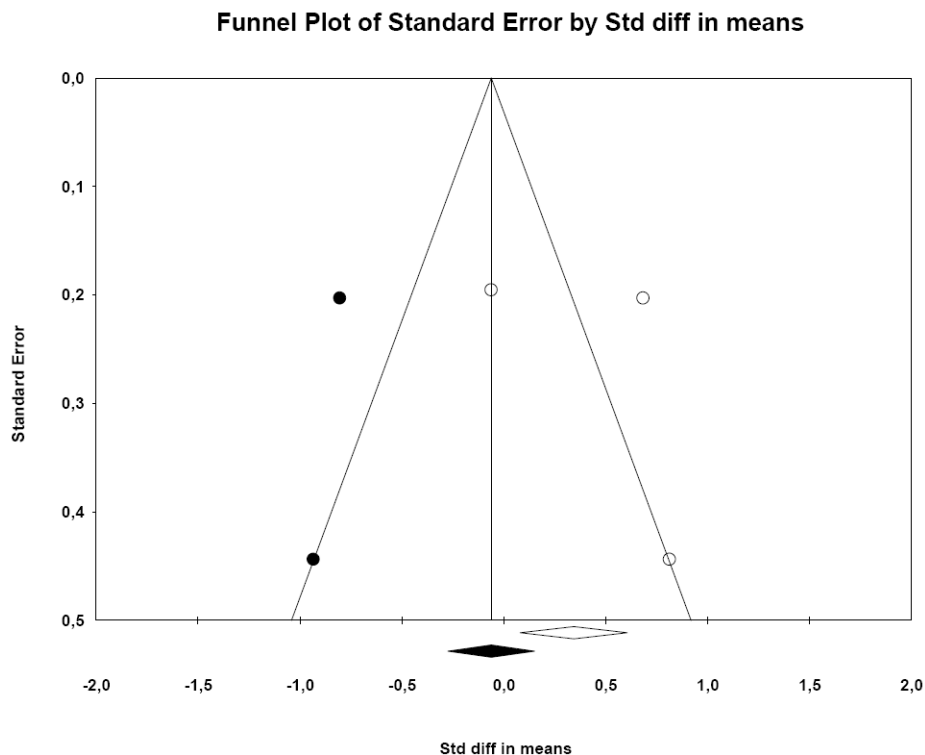
	Q	df (Q)	p	I ²
BED vs. Pre-Obese/Obese	8.241	2	0.010*	75.732
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				
<i>* p ≤ 0.01</i>				

The Q statistic is significant ($p = 0.010$). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effects-Model instead of a Fixed-Effect-Model. The I² indicates a value of 75.732%, which is indicative of high inconsistency across the findings of the studies.

The sensitivity analysis for Impulsivity showed that overall effects for the comparison “BED vs. Obese” did reach non-significance in one case.

Visual inspection of the funnel plot suggests effect homogeneity for the comparison group “BED vs. Obese” (see Figure 4).

Figure 4: Impulsivity – BED vs. Pre-Obese/Obese



The funnel plot of the comparison “BED vs. Pre-Obese/Obese” suggests asymmetry. The trim-and-fill analysis indicates 2 missing studies in overall effect size calculations for the “BED vs. Pre-Obese/Obese” comparison, requiring an adjustment of the overall effect size to $d = -0.06$ (95 % CI [-0.73, 0.71]). This could be interpreted as a tendency towards publication bias, as two more studies would be needed to receive symmetry. But since this estimation is based only on three studies, only a tendency towards publication bias can be suggested.

The Rosenthal’s Fail-Safe-N yielded 4 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “BED vs. Pre-Obese/Obese”.

4.1.3 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

The studies for the comparison “Pre-Obese/Obese vs. Normal-Weight” on Impulsivity found similar effect sizes. The test of Effect Heterogeneity across studies for Impulsivity (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 10.

Table 10: Test of Effect Heterogeneity across studies for Impulsivity (Pre-Obese/Obese vs. Normal-weight)

	Q	df (Q)	p	I ²
Pre-Obese/Obese vs. Normal-Weight	0.001	1	0.979	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is not significant ($p = 0.979$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

No sensitivity analysis was calculated for this comparison as there were only 2 studies.

No funnel plot was drawn for this comparison as there were only 2 studies.

4.2 Combined Effect Sizes for Binge-Eating-Disorder and Perfectionism

For the personality trait Perfectionism, an overall effect size was calculated for the three pairs of comparison (4 studies). The pair of comparison “BED vs. Normal-Weight” (3 study effects) yielded an effect size of $d = 0.525$ (95 % CI [0.24, 0.81]) which is a medium effect (Cohen, 1977). This means that there is a significant, although not very strong, difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people with Binge-Eating-Disorder show scores for Perfectionism that are higher, although not very much higher, than the scores of people with normal-weight. The pair of comparison “BED vs. Pre-obese/Obese” (3 study effects) yielded an effect size of $d = 0.450$ (95 % CI [-0.02, 0.92]) which is a medium effect (Cohen, 1977). This means that there is a significant, although not very strong, difference between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that pre-obese or obese people with Binge-Eating-Disorder show scores for Perfectionism that are higher, although not very much higher, than the scores of pre-obese or obese people without Binge-Eating-Disorder. The pair of comparison “Pre-obese/Obese vs. Normal-Weight” (2 study effects) yielded an effect size of $d = 0.072$ (95 % CI [-0.31, 0.46]) which is very small effect (Cohen, 1977). This means that there is a small, or even no

difference at all between pre-obese or obese people without Binge-Eating-Disorder and people with normal-weight, indicating that both groups show no difference for this trait.

The Forest-Plots are shown in Figure 5 to 7.

Figure 5: Random-Effects-Model

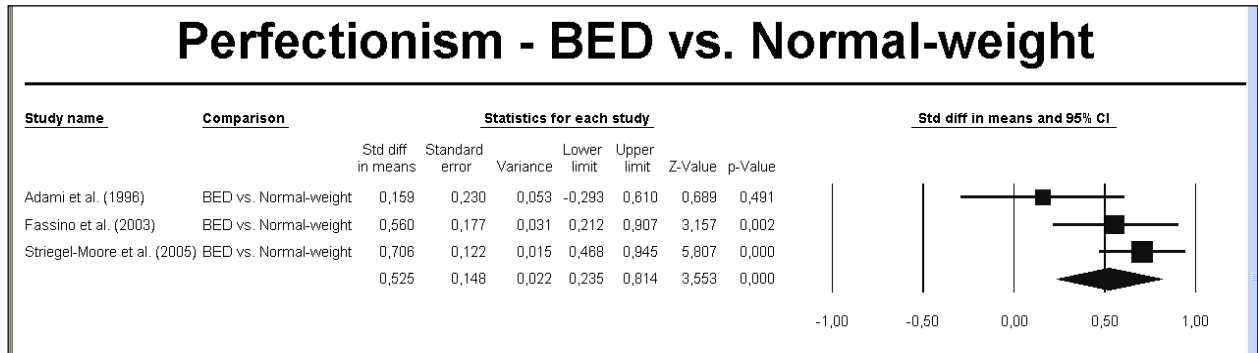
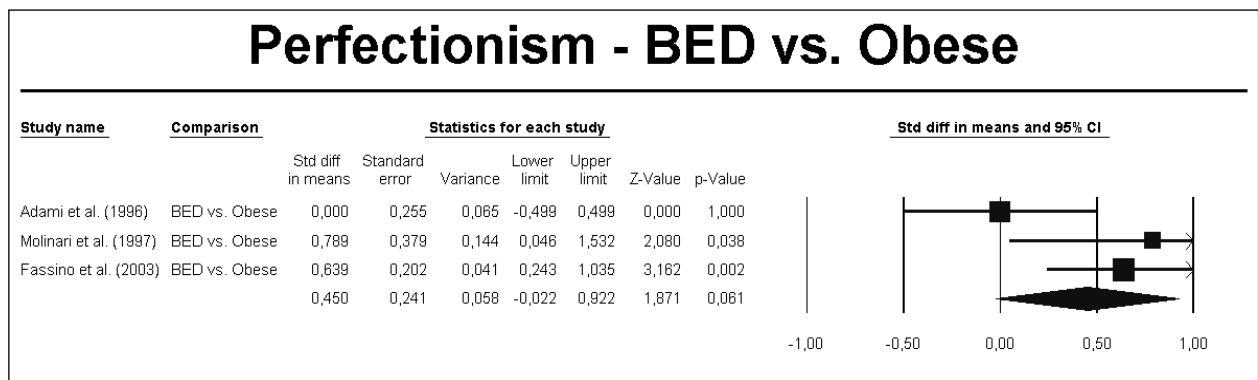
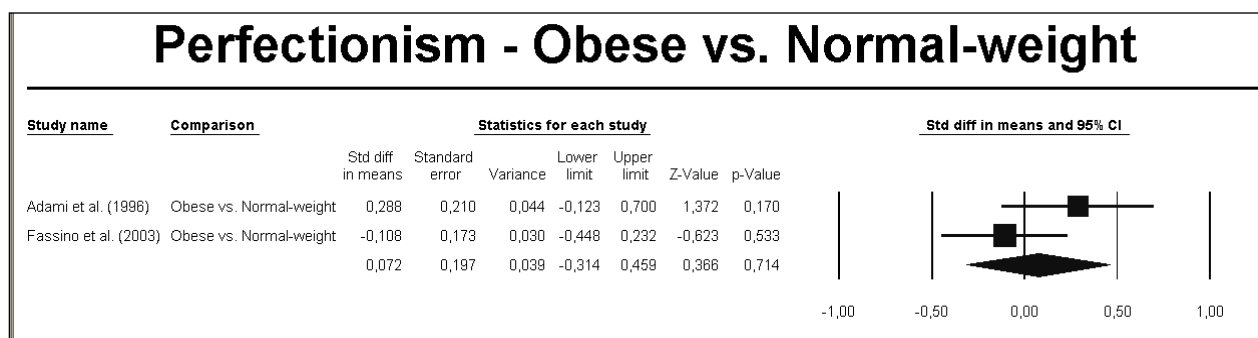


Figure 6: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

Figure 7: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

4.2.1 Analysis of Heterogeneity - BED vs. Normal-weight

Two of the three studies of the comparison “BED vs. Normal-weight” on perfectionism found a medium effect size (Cohen, 1977), while the third study only found a weak effect. However the effect was non-significant. The test of Effect Heterogeneity across studies for Perfectionism (BED vs. Normal-weight) can be seen in Table 11.

Table 11: Test of Effect Heterogeneity across studies for Perfectionism (BED vs. Normal-weight)

	Q	df (Q)	p	I²
BED vs. Normal Weight	4.436	2	0.109	54.915
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is not significant ($p = 0.109$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 54.915%, which is indicative of moderate inconsistency across the findings of the studies.

The sensitivity analysis for Perfectionism showed that the overall effect for the comparison “BED vs. Normal-Weight” did not reach non-significance when single studies were omitted in effect size calculations.

Visual inspection of the funnel plot suggests effect homogeneity as well as symmetry for the comparison “BED vs. Normal-weight”.

The trim-and-fill analysis indicates no missing studies for the “BED vs. Normal-weight” comparison. The Rosenthal’s Fail-Safe-N yielded 22 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “BED vs. Normal-weight” Since this result is based on only three studies, finding 22 more studies could be difficult; therefore the effect size for the comparison seems robust.

4.2.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

Two of the three studies of the comparison “BED vs. Pre-Obese/Obese” on perfectionism found a medium effect size (Cohen, 1977), while the third study found a very small effect. However the effect was non-significant. The test of Effect Heterogeneity across studies for Perfectionism (BED vs. Pre-Obese/Obese) can be seen in Table 12.

Table 12: Test of Effect Heterogeneity across studies for Perfectionism (BED vs. Pre-Obese/Obese)

	Q	df (Q)	p	I²
BED vs. Pre-Obese/Obese	4.796	2	0.091	58.302
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is not significant ($p = 0.091$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 58.302%, which is indicative of moderate inconsistency across the findings of the studies.

The sensitivity analysis for Perfectionism showed that the overall effect for the comparison “BED vs. Pre-Obese/Obese” reached non-significance in one case.

Visual inspection of the funnel plot suggests effect homogeneity as well as symmetry for the comparison “BED vs. Pre-Obese/Obese”.

The trim-and-fill analysis indicates no missing studies for the “BED vs. Pre-Obese/Obese” comparison.

The Rosenthal’s Fail-Safe-N yielded 5 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “BED vs. Pre-Obese/Obese”.

4.2.3 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

Both studies in the comparison “Pre-Obese/Obese vs. Normal-weight” only found a small effect size (Cohen, 1977), which was non-significant. The test of Effect Heterogeneity across studies for Perfectionism (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 13.

Table 13: Test of Effect Heterogeneity across studies for Perfectionism (Pre-Obese/Obese vs. Normal-weight)

	Q	df (Q)	p	I^2
Pre-Obese/Obese vs. Normal-Weight	2.117	1	0.146	52.774
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I^2)</i>				

The Q statistic is not significant ($p = 0.146$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 52.774%, which is indicative of moderate inconsistency across the findings of the studies.

No sensitivity analyses were calculated for the comparison “Pre-Obese/Obese vs. Normal-weight” as it included only 2 studies.

No funnel plot was drawn for the comparison “Pre-Obese/Obese vs. Normal-weight” as it included only 2 studies.

4.3 Combined Effect Sizes for Binge-Eating-Disorder and Ineffectiveness

For the personality trait Ineffectiveness, an overall effect size was calculated for the three pairs of comparison (3 studies). The pair of comparison “BED vs. Normal-Weight” (2 study effects) yielded an effect size of $d = 1.116$ (95 % CI [-0.84, 3.07]) which is a very strong effect (Cohen, 1977). This means that there is a highly significant difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people with Binge-Eating-Disorder show much higher scores for Ineffectiveness than people with normal-weight. The pair of comparison “BED vs. Pre-Obese/Obese” (3 study effects) yielded an effect size of $d = 0.490$ (95 % CI [-0.38, 1.36]) which is a medium effect (Cohen, 1977). This means that there is a significant, although not very strong, difference between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that pre-obese or obese people with Binge-Eating-Disorder show scores for Ineffectiveness that are higher, although not very much higher, than the scores of pre-obese or obese people without Binge-Eating-Disorder. The pair of comparison “Pre-Obese/Obese vs. Normal-Weight” (2 study effects) yielded an effect size of $d = 0.768$ (95 % CI [0.34, 1.20]) which is a strong effect (Cohen, 1977). This means that there is a highly significant difference between pre-obese or obese people without Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people without Binge-Eating-Disorder show much higher scores for Ineffectiveness than people with normal-weight. The Forest-Plots are shown in Figure 8 to 10.

Figure 8: Random-Effects-Model

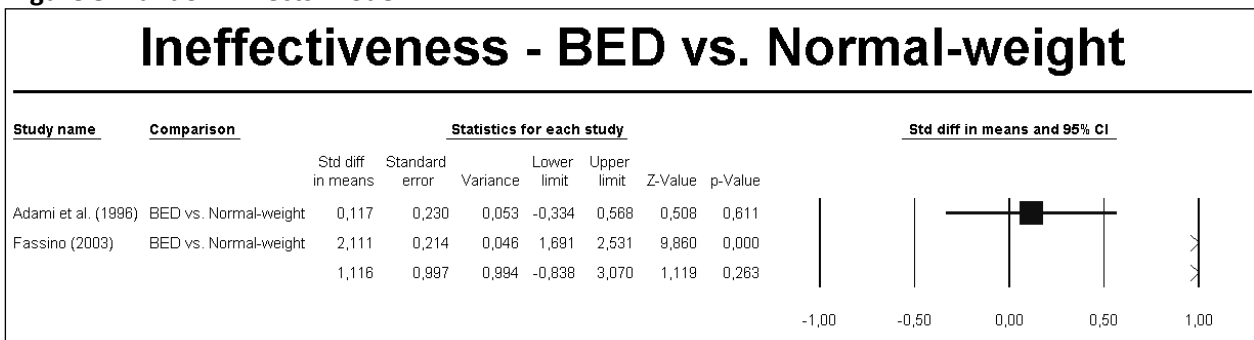
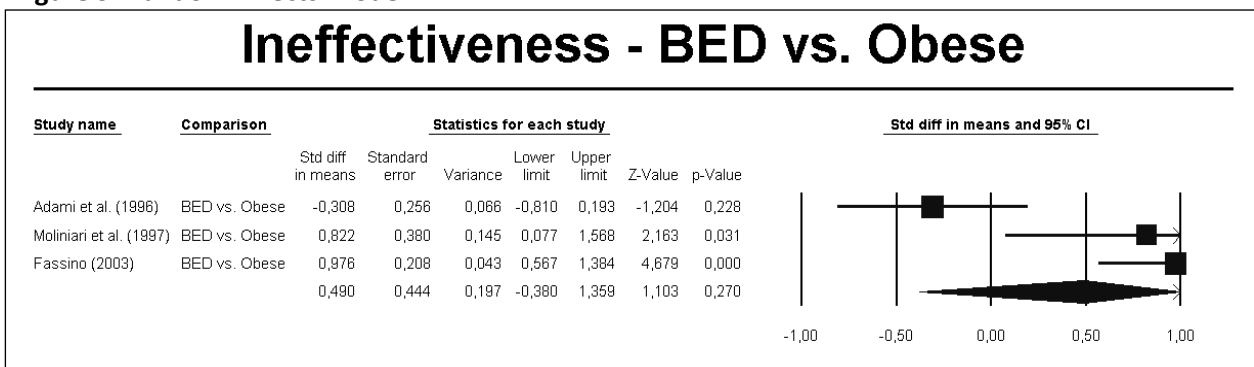
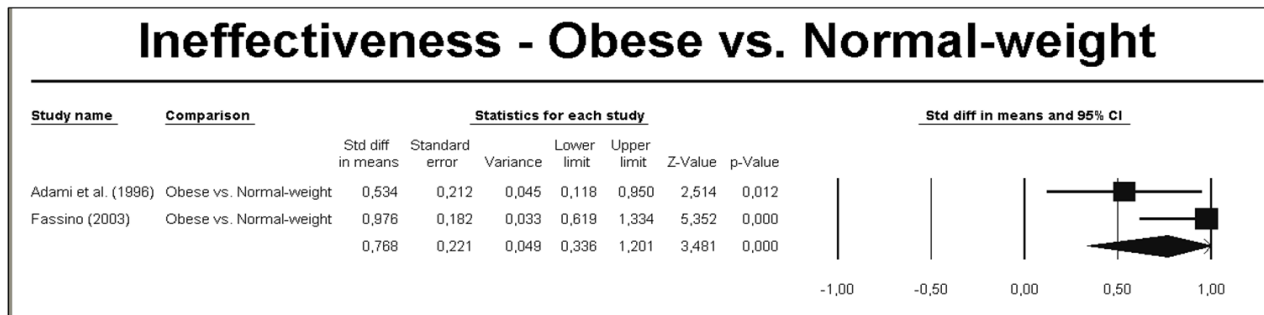


Figure 9: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

Figure 10: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

4.3.1 Analysis of Heterogeneity - BED vs. Normal-weight

For the comparison group “BED vs. Normal-Weight” on Ineffectiveness, two contrasted study effects with significantly different effect sizes were included for data analysis. The test of Effect Heterogeneity across studies for Ineffectiveness (BED vs. Normal-weight) can be seen in Table 14.

Table 14: Test of Effect Heterogeneity across studies for Ineffectiveness (BED vs. Normal-weight)

	Q	df (Q)	p	I ²
BED vs. Normal Weight	40.238	1	0.000*	97.515
Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I ²)				
* p < 0.01				

The Q statistic is significant (p = 0.000). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effect-Model. The I² indicates a value of 97.515%, which is indicative of high inconsistency across the findings of the studies.

No sensitivity analysis was calculated for the comparison “BED vs. Normal-weight” since it included only 2 studies.

No funnel plot was drawn for this comparison as it included only 2 studies.

4.3.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

For the comparison “BED vs. Pre-Obese/Obese” on Ineffectiveness, two of the three studies found a very strong effect (Cohen, 1977). In contrast, the remaining study found an effect about null (d = -0.308). The test of Effect Heterogeneity across studies for Ineffectiveness (BED vs. Pre-Obese/Obese) can be seen in Table 15.

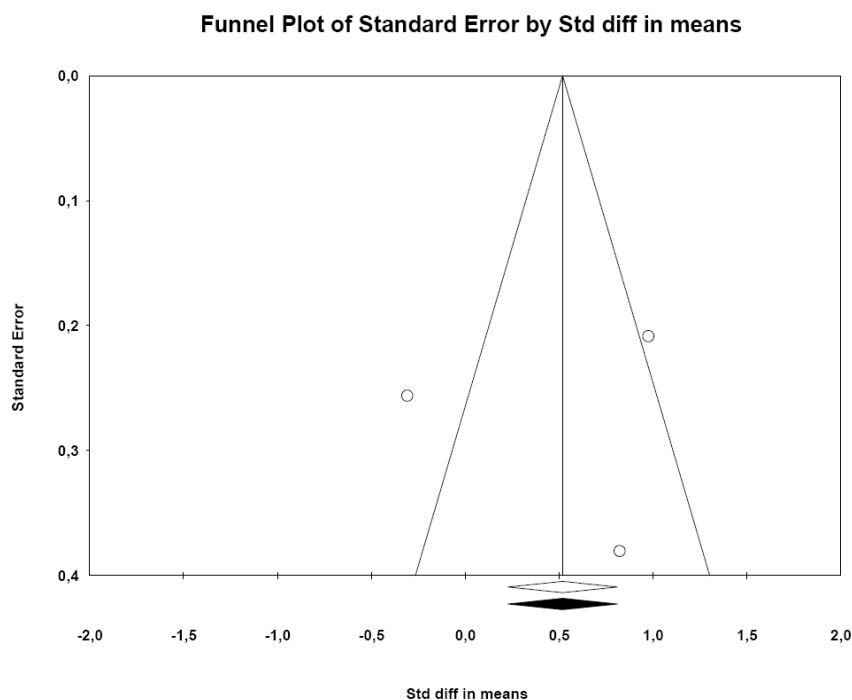
Table 15: Test of Effect Heterogeneity across studies for Ineffectiveness (BED vs. Pre-Obese/Obese)

	Q	df (Q)	p	I²
BED vs. Pre-Obese/Obese	15.873	2	0.000*	87.400
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				
<i>* $p < 0.01$</i>				

The Q statistic is significant ($p = 0.000$). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effect-Model. The I^2 indicates a value of 87.400%, which is indicative of high inconsistency across the findings of the studies.

The sensitivity analysis for Ineffectiveness showed that overall effects for the comparison group “BED vs. Pre-Obese/Obese” did reach non-significance in two cases.

Visual inspection of the funnel plot suggests effect heterogeneity for the comparison group “BED vs. Pre-Obese/Obese” (see Figure 11).

Figure 11: Ineffectiveness – BED vs. Pre-Obese/Obese

The funnel plot of the comparison group “BED vs. Pre-Obese/Obese” suggests symmetry. The trim-and-fill analysis indicates no missing studies for the “BED vs. Pre-Obese/Obese” comparison group. The Rosenthal’s Fail-Safe-N yielded 6 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison group “BED vs. Pre-Obese/Obese”.

4.3.3 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

One of the two studies of the comparison group “Pre-Obese/Obese vs. Normal-Weight” on Ineffectiveness showed a medium effect, while the other one showed a strong effect (Cohen, 1977), however the effect was non-significant. The test of Effect Heterogeneity across studies for Ineffectiveness (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 16.

Table 16: Test of Effect Heterogeneity across studies for Ineffectiveness (Pre-Obese/Obese vs. Normal-weight)

	Q	df (Q)	p	I ²
Pre-Obese/Obese vs. Normal-Weight	2.496	1	0.114	59.941
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.114$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I² indicates a value of 59.941%, which is indicative of moderate inconsistency across the findings of the studies.

No sensitivity analysis was calculated for the comparison “Pre-Obese/Obese vs. Normal-weight” since it included only 2 studies.

No funnel plot was drawn for this comparison as it included only 2 studies.

4.4 Combined Effect Sizes for Binge-Eating-Disorder and Harm-Avoidance

For the personality trait Harm Avoidance, an overall effect size was calculated for the three pairs of comparison (4 studies). The pair of comparison “BED vs. Normal-Weight” (4 study effects) yielded an effect size of $d = 0.703$ (95 % CI [0.54, 0.87]) which is a strong effect (Cohen, 1977). This means that there is a highly significant difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people with Binge-Eating-Disorder show much higher scores for Harm-Avoidance than people with normal-weight. The pair of comparison “BED vs. Pre-Obese/Obese” (4 study effects) yielded an effect size of $d = 0.305$ (95 % CI [0.13, 0.48]) which is a small effect (Cohen, 1977). This means that there is a small, or even no difference at all between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that both groups show no difference for this trait. The pair of comparison “Pre-Obese/Obese vs. Normal-Weight” (4 study effects) yielded an effect size of $d = 0.346$ (95 % CI [0.18, 0.51]) which is a small effect (Cohen, 1977). This means that there is a small, or even no difference at all between pre-obese or obese people without Binge-

Eating-Disorder and people with normal-weight, indicating that both groups show no difference for this trait.

The Forest-Plots are shown in Figure 12 to 14.

Figure 12: Random-Effects-Model

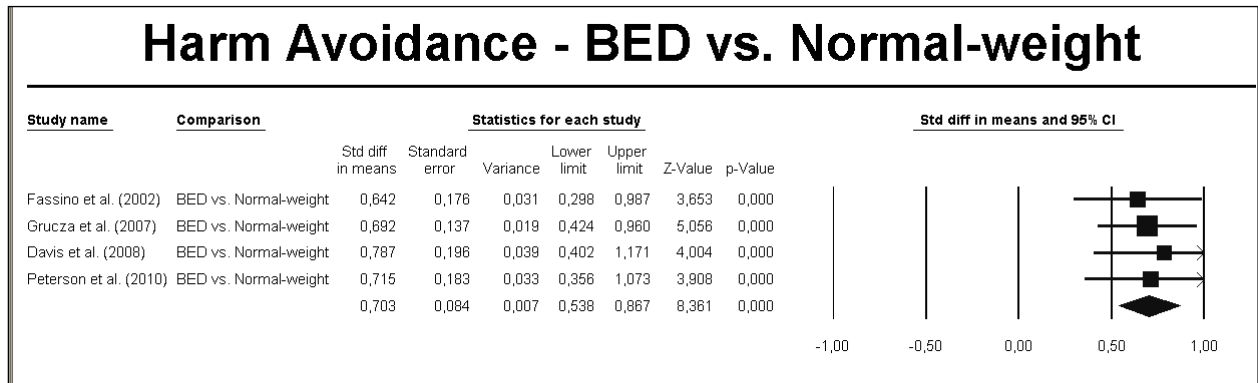
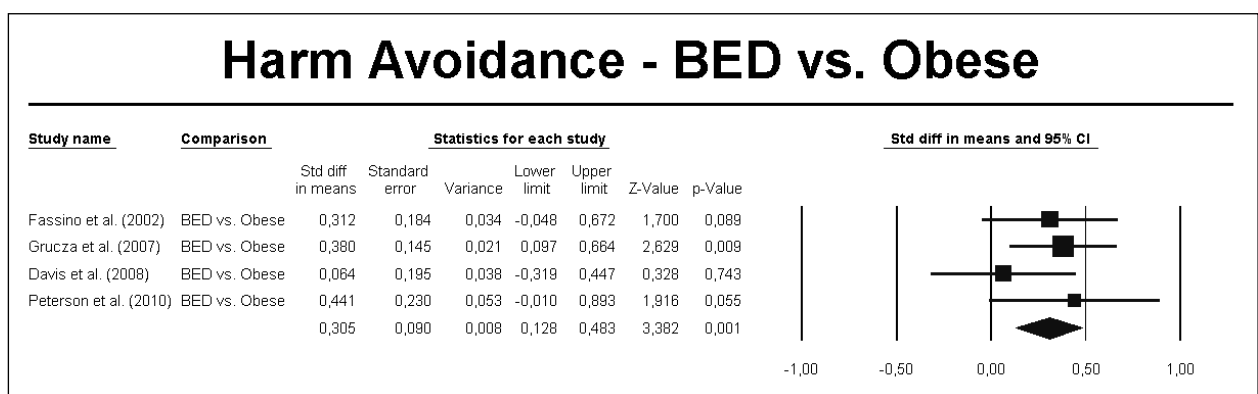
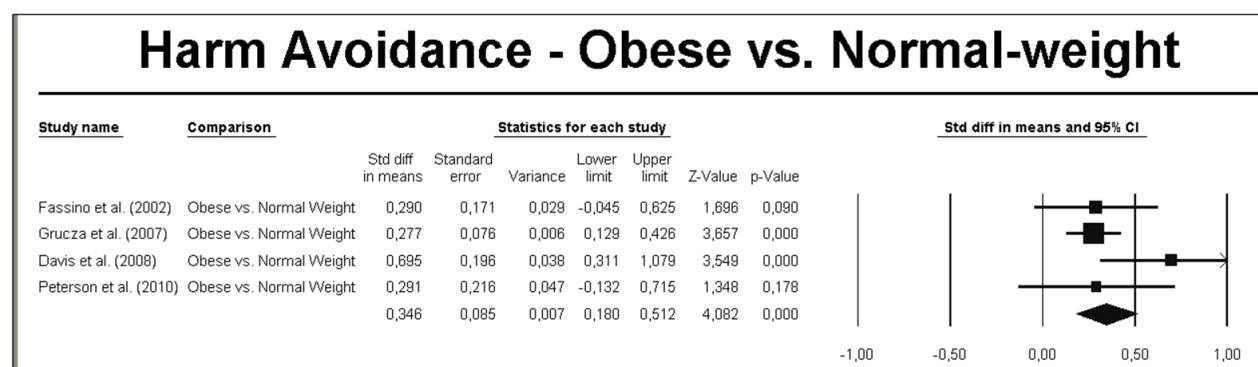


Figure 13: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as "Obese" in this figure

Figure 14: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as "Obese" in this figure

4.4.1 Analysis of Heterogeneity - BED vs. Normal-weight

The four studies found a strong effect (Cohen, 1977). However the effect was non-significant. The test of Effect Heterogeneity across studies for Harm Avoidance (BED vs. Normal-weight) can be seen in Table 17.

Table 17: Test of Effect Heterogeneity across studies for Harm Avoidance (BED vs. Normal-weight)

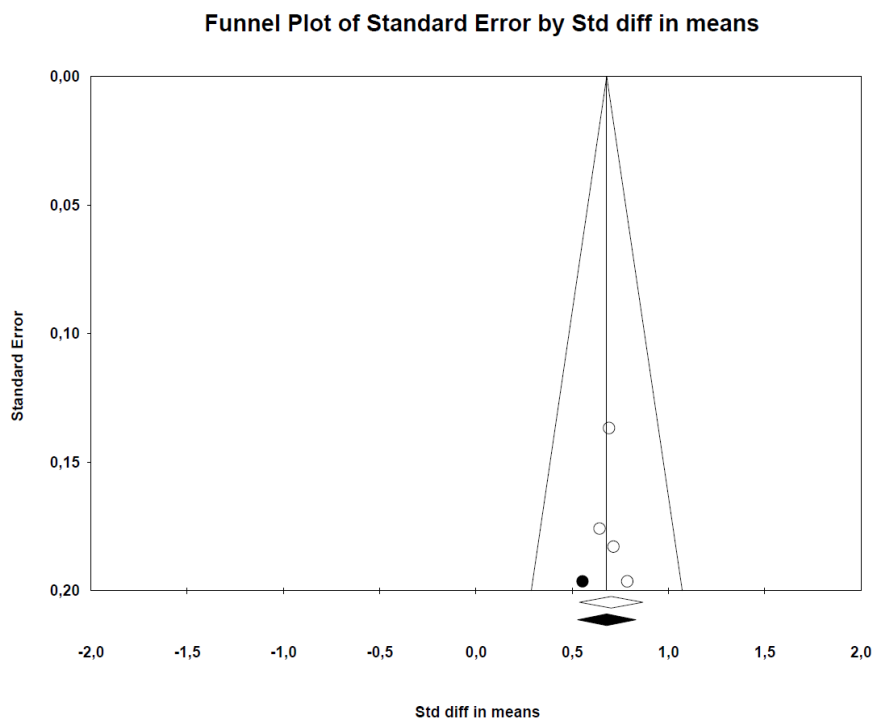
	Q	df (Q)	P	I ²
BED vs. Normal Weight	0.310	3	0.958	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.958$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I² indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

The sensitivity analysis for Harm Avoidance showed that the overall effect did not reach non-significance when single studies were omitted in effect size calculations for the comparison “BED vs. Normal-Weight”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison (see Figure 15).

Figure 15: Harm Avoidance – BED vs. Normal-weight



The funnel plot of the comparison “BED vs. Normal-Weight” and “BED vs. Pre-Obese/Obese” suggest asymmetry. The trim-and-fill analysis indicates 1 missing study for the comparison “BED vs. Normal-Weight”, requiring an adjustment of the overall effect to $d = 0.68$ (95 % CI [0.53, 0.83]). But since this estimation is based only on four studies, only a tendency towards publication bias can be suggested.

The Rosenthal’s Fail-Safe-N yielded 68 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison group “BED vs. Normal-Weight”. Since the result for the comparison “BED vs. Normal-weight” is based on only four studies, finding 68 more studies could be difficult; therefore the effect size for this comparison seems very robust.

4.4.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

Three of the four studies in the comparison “BED vs. Pre-Obese/Obese” found a small effect, while the fourth study showed an effect close to null ($d = 0.064$). However, the effect was non-significant. The test of Effect Heterogeneity across studies for Harm Avoidance (BED vs. Pre-Obese/Obese) can be seen in Table 18.

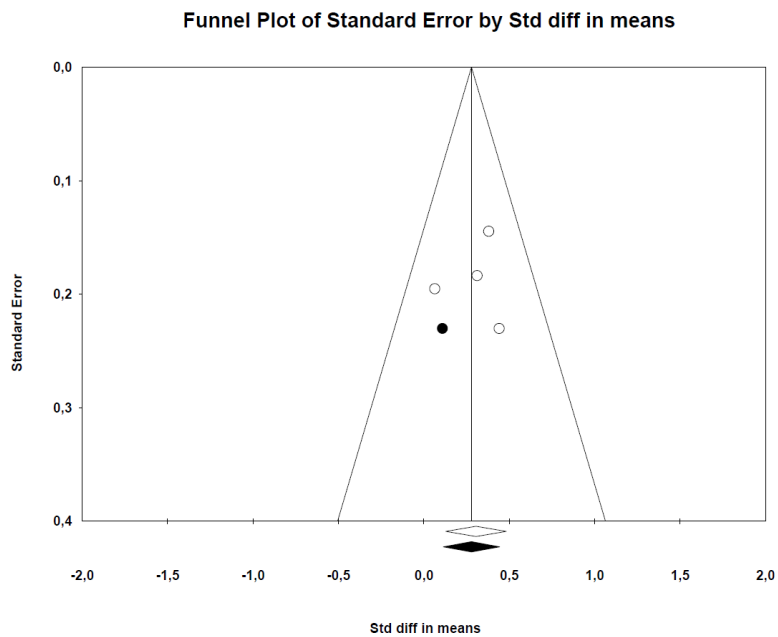
Table 18: Test of Effect Heterogeneity across studies for Harm Avoidance (BED vs. Pre-Obese/Obese)

	Q	df (Q)	P	I ²
BED vs. Pre-Obese/Obese	2.145	3	0.543	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.543$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I² indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

The sensitivity analysis for Harm Avoidance showed that the overall effect did not reach non-significance when single studies were omitted in effect size calculations for the comparison “BED vs. Pre-Obese/Obese”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison (see Figure 16).

Figure 16: Harm Avoidance – BED vs. Pre-Obese/Obese

The trim-and-fill analysis indicates 1 missing study for the comparison “BED vs. Pre-Obese/Obese” in overall effect size calculations, requiring an adjustment of the overall effect to $d = 0.28$ (95 % CI [0.11, 0.44]). But since this estimation is based only on four studies, only a tendency towards publication bias can be suggested.

The Rosenthal’s Fail-Safe-N yielded 8 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison group “BED vs. Pre-Obese/Obese”.

4.4.3 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

Three of the four studies in the comparison “Pre-Obese/Obese vs. Normal-weight” found a small effect, while the fourth study found a medium effect (Cohen, 1977). However, the effect remained non-significant. The test of Effect Heterogeneity across studies for Harm Avoidance (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 19.

Table 19: Test of Effect Heterogeneity across studies for Harm Avoidance (Pre-Obese/Obese vs. Normal-weight)				
	Q	df (Q)	P	I²
Pre-Obese/Obese vs. Normal-Weight	4.036	3	0.258	25.662
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.258$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 25.662%, which is indicative of low inconsistency across the findings of the studies.

The sensitivity analysis for Harm Avoidance showed that the overall effect did not reach non-significance when single studies were omitted in effect size calculations for the comparison “Pre-Obese/Obese vs. Normal-weight”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison.

The funnel plot of the comparison group “Pre-Obese/Obese vs. Normal-Weight” suggests symmetry.

The Rosenthal’s Fail-Safe-N yielded 24 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “Pre-Obese/Obese vs. Normal-Weight”. Since the result for the comparison “Pre-Obese/Obese vs. Normal-Weight” is based on only four studies, finding 24 more studies could be difficult; therefore the effect size for this comparison seems very robust.

4.5 Combined Effect Sizes for Binge-Eating-Disorder and Reward

Dependence

For the personality trait Reward Dependence, an overall effect size was calculated for the three pairs of comparison (3 studies). The pair of comparison “BED vs. Normal-Weight” (3 study effects) yielded an effect size of $d = -0.063$ (95 % CI [-0.25, 0.12]), which is a very small effect (Cohen, 1977). This means that there is no difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that both groups show no difference for this trait. The pair of comparison “BED vs. Pre-Obese/Obese” (3 study effects) yielded an effect size of $d = 0.036$ (95 % CI [-0.23, 0.30]), which is a very small effect (Cohen, 1977). This means that there is no difference between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that both groups show no difference for this trait. The pair of comparison (“Pre-Obese/Obese vs. Normal-Weight” (3 study effects) yielded an effect size of $d = -0.025$ (95 % CI [-0.15, 0.10]), which is a very small effect (Cohen, 1977). This means that there is no difference between pre-obese or obese people without Binge-Eating-Disorder and people with normal-weight, indicating that both groups show no difference for this trait.

The Forest-Plots are shown in Figure 17 to 19.

Figure 17: Random-Effects-Model

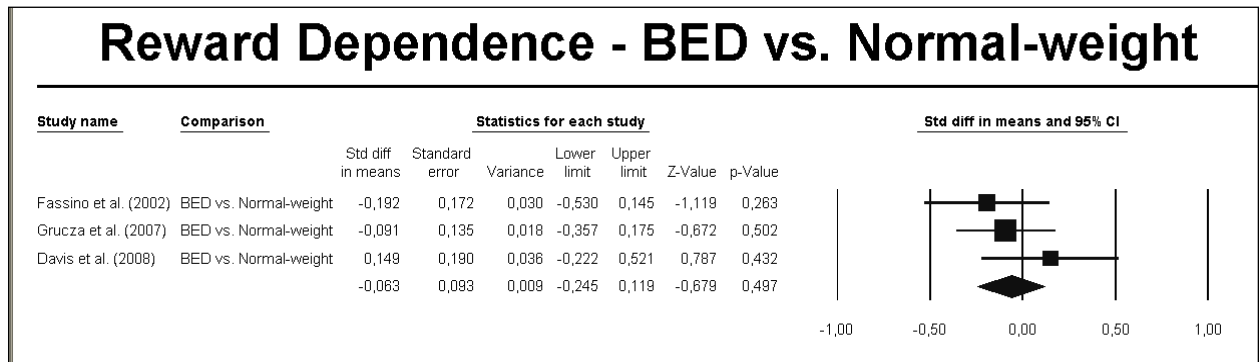
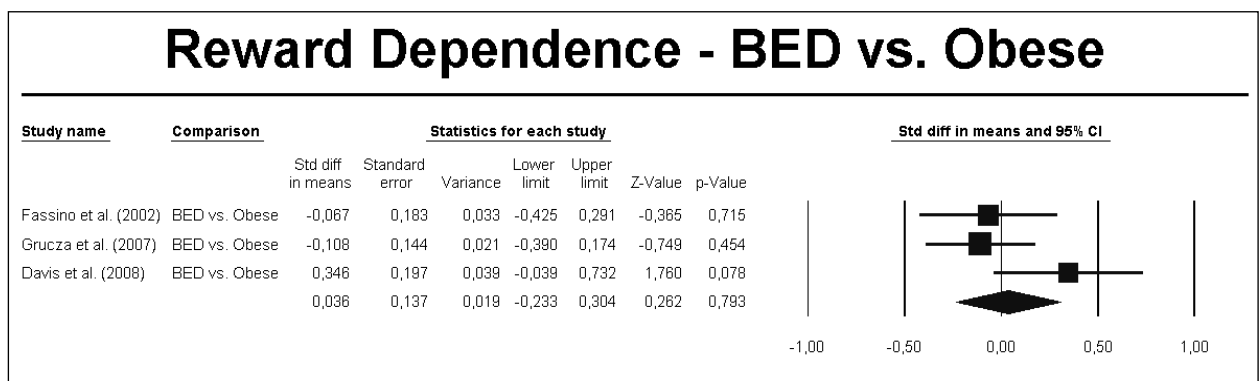
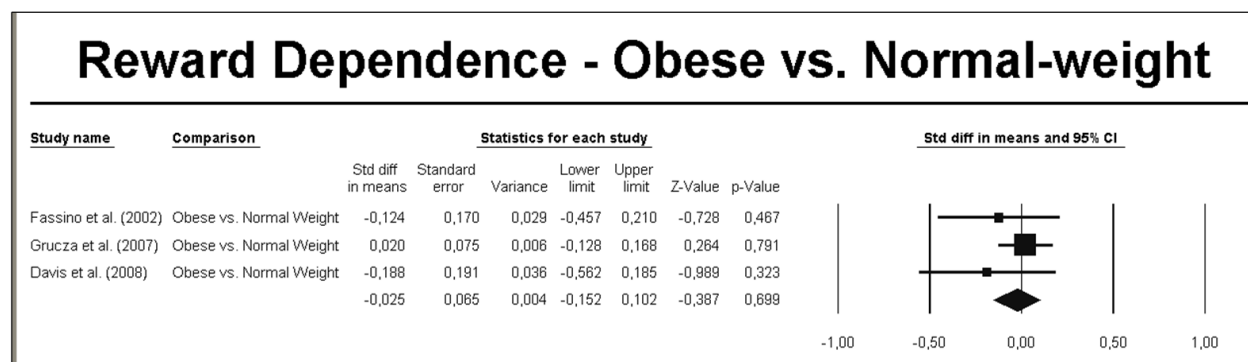


Figure 18: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

Figure 19: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

4.5.1 Analysis of Heterogeneity - BED vs. Normal-weight

The three studies in the comparison “BED vs. Normal-weight” showed an effect close to null. The test of Effect Heterogeneity across studies for Reward Dependence (BED vs. Normal-weight) can be seen in Table 20.

Table 20: Test of Effect Heterogeneity across studies for Reward Dependence

	Q	df (Q)	p	I²
BED vs. Normal Weight	1.862	2	0.394	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.394$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

The sensitivity analysis for Reward Dependence showed that the overall effect did reach non-significance in all three studies when single studies were omitted in effect size calculations for the comparison “BED vs. Normal-weight”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison.

The funnel plot of the comparison group “BED vs. Normal-Weight” suggests symmetry.

4.5.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

The three studies in the comparison “BED vs. Normal-weight” showed an effect close to null. The test of Effect Heterogeneity across studies Reward Dependence (BED vs. Pre-Obese/Obese) can be seen in Table 21.

Table 21: Test of Effect Heterogeneity across studies for Reward Dependence (Bed vs. Pre-Obese/Obese)

	Q	df (Q)	p	I²
BED vs. Pre-Obese/Obese	3.763	2	0.125	46.857
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.125$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 46.857%, which is indicative of moderate inconsistency across the findings of the studies.

The sensitivity analysis for Reward Dependence showed that the overall effect did reach non-significance in all three studies when single studies were omitted in effect size calculations for the comparison “BED vs. Pre-Obese/Obese”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison.

The funnel plot of the comparison group “BED vs. Pre-Obese/Obese” suggests symmetry.

4.5.3 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

The three studies in the comparison “Pre-Obese/Obese vs. Normal-weight” showed an effect close to null. The test of Effect Heterogeneity across studies for Reward Dependence (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 22.

Table 22: Test of Effect Heterogeneity across studies for Reward Dependence (Pre-Obese/Obese vs. Normal-weight)

	Q	df (Q)	p	I ²
Pre-Obese/Obese vs. Normal-Weight	1.428	2	0.490	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.490$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

The sensitivity analysis for Reward Dependence showed that the overall effect did reach non-significance in all three studies when single studies were omitted in effect size calculations for the comparison “Pre-Obese/Obese vs. Normal-weight”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison.

The funnel plot of the comparison group “Pre-Obese/Obese vs. Normal-Weight” suggests symmetry.

4.6 Combined Effect Sizes for Binge-Eating-Disorder and Novelty Seeking

For the personality trait Novelty Seeking, an overall effect size was calculated for the three pairs of comparison (3 studies). The pair of comparison “BED vs. Normal-Weight” (3 study effects) yielded an effect size of $d = 0.470$ (95 % CI [0.29, 0.65]), which is a medium effect (Cohen, 1977). This means that there is a significant, although not very strong, difference between pre-obese or obese people with Binge-Eating-Disorder and people with normal-weight, indicating that pre-obese or obese people with Binge-Eating-Disorder show scores for Perfectionism that are higher, although not very much higher, than the scores of people with normal weight. The pair of comparison (“BED vs. Pre-Obese/Obese” (3 study effects) yielded an effect size of $d = 0.105$ (95 % CI [-0.31, 0.52]), which is a very small effect (Cohen, 1977). This means that there is a small, or even no difference at all between pre-obese or obese people with Binge-Eating-Disorder and pre-obese or obese people without Binge-Eating-Disorder, indicating that both groups show no difference for this trait. The

pair of comparison “Pre-Obese/Obese vs. Normal-Weight” (3 study effects) yielded an effect size of $d = 0.374$ (95 % CI [-0.05, 0.79]), which is a very small effect (Cohen, 1977). This means that there is a small, or even no difference at all between pre-obese or obese people without Binge-Eating-Disorder and people with normal-weight, indicating that both groups show no difference for this trait.

The Forest-Plots are shown in Figure 20 to 22.

Figure 20: Random-Effects-Model

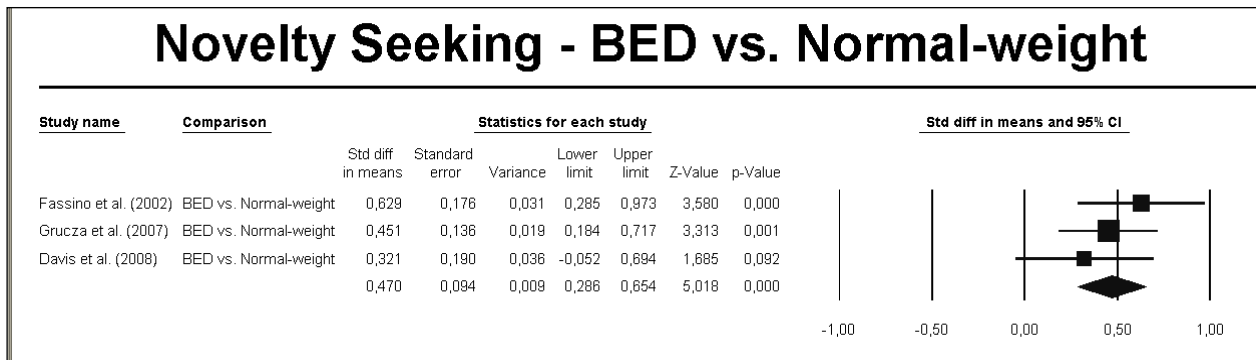
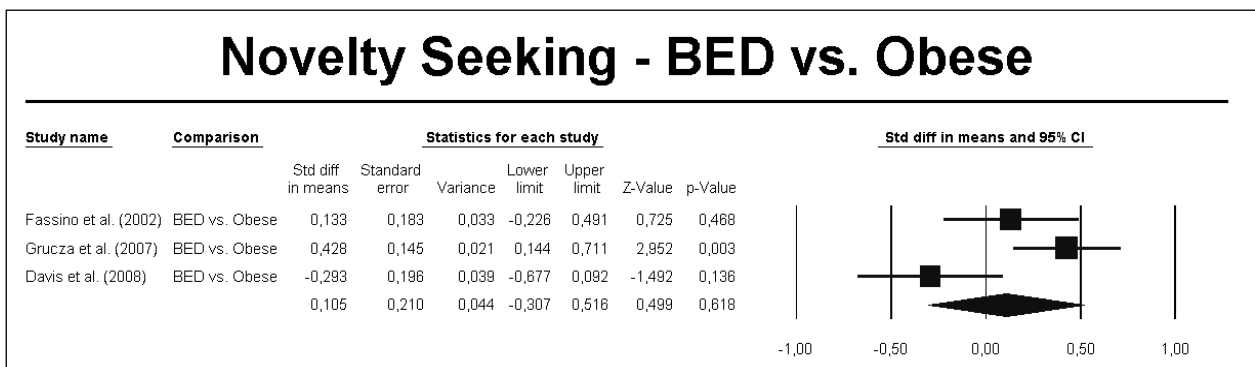
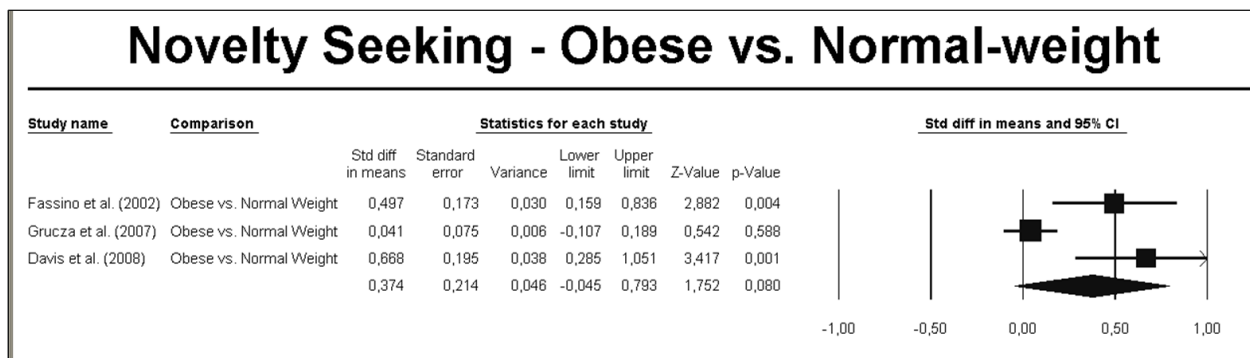


Figure 21: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

Figure 22: Random-Effects-Model



NOTE: For reasons of readability, both pre-obese and obese individuals are referred to as “Obese” in this figure

4.6.1 Analysis of Heterogeneity - BED vs. Normal-weight

Two of the three studies showed a medium effect while the third study showed a small effect (Cohen, 1977). However, the effect was non-significant. The test of Effect Heterogeneity across studies for Novelty Seeking (BED vs. Normal-weight) can be seen in Table 23.

Table 23: Test of Effect Heterogeneity across studies for Novelty Seeking (BED vs. Normal-weight)				
	Q	df (Q)	p	I²
BED vs. Normal Weight	1.452	2	0.484	0.000
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i>				

The Q statistic is non-significant ($p = 0.484$). This indicates that there is homogeneity between the studies. This would lead to the assumption of a Fixed-Effect-Model. The I^2 indicates a value of 0.000%, which is indicative of no inconsistency across the findings of the studies.

The sensitivity analysis for Novelty Seeking showed that the overall effect did not reach non-significance when single studies were omitted in effect size calculations for the comparison “BED vs. Normal-weight”.

The visual inspection of the funnel plot suggests effect homogeneity for this comparison.

The funnel plot of the comparison group “Pre-Obese/Obese vs. Normal-Weight” suggests symmetry.

The Rosenthal’s Fail-Safe-N yielded 17 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “BED vs. Normal-Weight”. Since the result for the comparison “BED vs. Normal-Weight” is based on only three studies, finding 17 more studies could be difficult; therefore the effect size for this comparison seems robust.

4.6.2 Analysis of Heterogeneity - BED vs. Pre-Obese/Obese

For the comparison “BED vs. Pre-Obese/Obese” on Novelty Seeking, two of the three studies found a small effect (Cohen, 1977). In contrast, the remaining study found a medium effect ($d = 0.428$). The test of Effect Heterogeneity across studies for Novelty Seeking (BED vs. Pre-Obese/Obese) can be seen in Table 24.

Table 24: Test of Effect Heterogeneity across studies for Novelty Seeking (Bed vs. Pre-Obese/Obese)

	Q	df (Q)	p	I²
BED vs. Pre-Obese/Obese	8.758	2	0.013*	77.164
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i> * $p < 0.01$				

The Q statistic is significant ($p = 0.013$). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effect-Model. The I^2 indicates a value of 77.164%, which is indicative of high inconsistency across the findings of the studies.

The sensitivity analysis for Novelty Seeking showed that the overall effect did reach non-significance in two of three studies when single studies were omitted in effect size calculations for the comparison “BED vs. Pre-Obese/Obese”.

Visual inspection of the funnel plot suggests effect heterogeneity for the comparison group “BED vs. Pre-Obese/Obese”.

The funnel plot of the comparison group “BED vs. Pre-Obese/Obese” suggests symmetry.

4.6.4 Analysis of Heterogeneity - Pre-Obese/Obese vs. Normal-weight

For the comparison “Pre-Obese/Obese vs. Normal-weight” on Novelty Seeking, two of the three studies found a medium effect (Cohen, 1977). In contrast, the remaining study found an effect about null ($d = 0.041$). The test of Effect Heterogeneity across studies for Novelty Seeking (Pre-Obese/Obese vs. Normal-weight) can be seen in Table 25.

Table 25: Test of Effect Heterogeneity across studies for Novelty Seeking (Pre-Obese/Obese vs. Normal-weight)

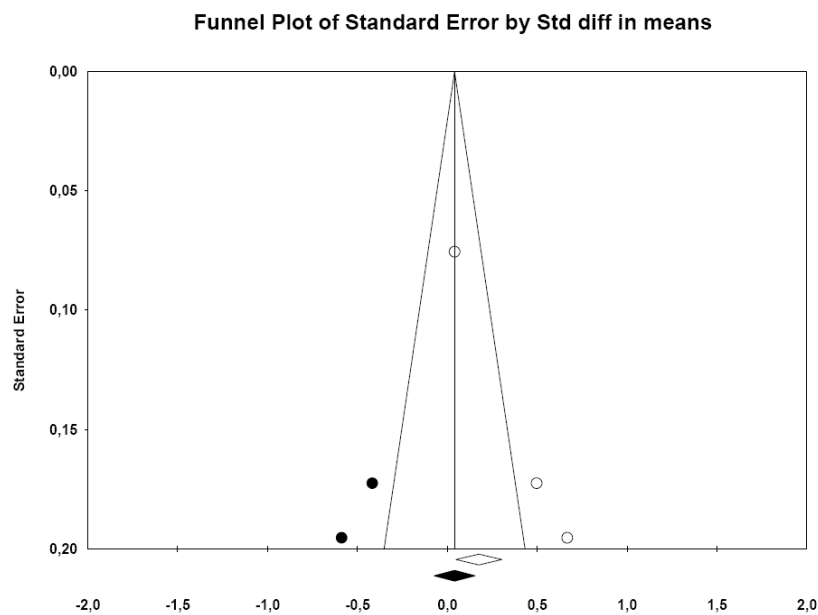
	Q	df (Q)	p	I²
Pre-Obese/Obese vs. Normal-Weight	13.000	2	0.002*	84.615
<i>Weighted sum of squares (Q), degrees of freedom (df), level of significance (p), inconsistencies across study findings (I²)</i> * $p < 0.01$				

The Q statistic is significant ($p = 0.002$). This indicates that there is heterogeneity between the studies. This would lead to the assumption of a Random-Effect-Model. The I^2 indicates a value of 84.615%, which is indicative of high inconsistency across the findings of the studies.

The sensitivity analysis for Novelty Seeking showed that the overall effect did reach non-significance in two of three studies when single studies were omitted in effect size calculations for the comparison “Pre-Obese/Obese vs. Normal-weight”.

Visual inspection of the funnel plot suggests effect heterogeneity for the comparison group “Pre-Obese/Obese vs. Normal-weight” (see Figure 23).

Figure 23: Novelty Seeking – BED vs. Pre-Obese/Obese



The funnel plot of the comparison group “BED vs. Pre-Obese/Obese” suggests asymmetry. The trim-and-fill analysis indicates 2 missing studies for the comparison “Pre-Obese/Obese vs. Normal-Weight”, requiring an adjustment of the overall effect to $d = 0.04$ (95 % CI [-0.35, 0.43]). But since this estimation is based only on three studies, only a tendency towards publication bias can be suggested.

The Rosenthal’s Fail-Safe-N yielded 10 studies showing null results that would have to be added to effect-size calculation in order to reach non-significance in the overall effect for the comparison “BED vs. Pre-Obese/Obese”.

4.7 Summary of the Results

The meta-analyses focussed on the three pairs of comparison “BED vs. Normal-weight”, “BED vs. Pre-Obese/Obese” and “Pre-Obese/Obese vs. Normal-weight” on the six personality traits Impulsivity, Perfectionism, Ineffectiveness, Harm Avoidance, Reward Dependence and Novelty Seeking.

The Effect Sizes for the six personality traits for the three pairs of comparison are shown below in Table 26. As a reminder, the three pairs of comparison are:

- (1) pre-obese or obese people with Binge-Eating-Disorder versus people with normal-weight without Binge-Eating-Disorder (“BED vs. Normal-weight”),
- (2) pre-obese or obese people with Binge-Eating-Disorder versus pre-obese or obese people without Binge-Eating-Disorder (“BED vs. Pre-Obese/Obese”) and
- (3) pre-obese or obese people without Binge-Eating-Disorder versus people with normal-weight without Binge-Eating-Disorder (“Pre-Obese/Obese vs. Normal-weight”).

Table 26: Effect Sizes of the six personality traits for the three pairs of comparison

	BED vs. Normal-weight	BED vs. Pre-Obese/Obese	Pre-Obese/Obese vs. Normal-weight
Impulsivity	1.060	0.424	0.776
Perfectionism	0.525	0.450	0.072
Ineffectiveness	1.116	0.490	0.768
Harm Avoidance	0.703	0.305	0.346
Reward Dependence	-0.063	0.036	-0.025
Novelty Seeking	0.470	0.105	0.374

The meta-analyses showed that for the personality trait **Impulsivity**, there was a strong effect for “BED vs. Normal-weight”, a medium effect for “BED vs. Pre-Obese/Obese” and a strong effect for “Pre-Obese/Obese vs. Normal-weight”. A strong effect points out that there is a highly significant difference between two pairs of comparison. This means that the personality trait Impulsivity is higher in pre-obese or obese individuals with Binge-Eating-Disorder than in pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal weight, and higher in pre-obese or obese individuals without Binge-Eating-Disorder than in individuals with normal weight.

The meta-analyses further showed that for the personality trait **Perfectionism**, there was a medium effect for “BED vs. Normal-weight”, a medium effect for “BED vs. Pre-Obese/Obese” and a small

effect for “Pre-Obese/Obese vs. Normal-weight”. This means that the personality trait Perfectionism is higher, although not very much higher in pre-obese or obese individuals with Binge-Eating-Disorder than in pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal weight. There is no difference in Perfectionism between pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal weight.

The meta-analyses also showed that for the personality trait **Ineffectiveness**, there was a strong effect for “BED vs. Normal-weight”, a medium effect for “BED vs. Pre-Obese/Obese” and a medium effect for “Pre-Obese/Obese vs. Normal-weight”. This means that the personality trait Ineffectiveness is higher in pre-obese or obese individuals with Binge-Eating-Disorder than in individuals with normal weight and higher in pre-obese or obese individuals without Binge-Eating-Disorder than in individuals with normal weight. The personality trait Ineffectiveness is higher, although not very much higher, in pre-obese or obese individuals with Binge-Eating-Disorder than in pre-obese or obese individuals without Binge-Eating-Disorder.

Furthermore, the meta-analyses showed that for the personality trait **Harm Avoidance**, there was a strong effect for “BED vs. Normal-weight”, a small effect for “BED vs. Pre-Obese/Obese” and a small effect for “Pre-Obese/Obese vs. Normal-weight”. This means that the personality trait Harm Avoidance is higher in pre-obese or obese individuals with Binge-Eating-Disorder than in individuals with normal weight. There seems to be only a small difference, if any, in Harm Avoidance between pre-obese or obese individuals with Binge-Eating-Disorder and pre-obese or obese individuals without Binge-Eating-Disorder and between pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight.

The meta-analyses also showed that for the personality trait **Reward Dependence**, there were small effects for all three pairs of comparison. This means that the three pairs of comparison do not differ in this personality Trait.

Finally, the meta-analyses showed that for the personality trait **Novelty Seeking**, there was a medium effect for “BED vs. Normal-weight”, a small effect for “BED vs. Pre-Obese/Obese” and a small effect for “Pre-Obese/Obese vs. Normal-weight”. This means that the personality trait Novelty Seeking is higher, although not very much higher in pre-obese or obese individuals with Binge-Eating-Disorder than in individuals with normal weight. There seems to be only a small difference, if any, in Novelty Seeking between pre-obese or obese individuals with Binge-Eating-Disorder and pre-obese or obese individuals without Binge-Eating-Disorder and between pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight.

5 Discussion

5.1 Overview

The present study examined Binge-Eating-Disorder and specific personality traits by conducting a systematic review and meta-analyses of studies. The purpose of the study was to identify personality dimensions that are relevant for the development, maintenance and treatment of Binge-Eating-Disorder and for the identification of Binge-Eating-Disorder as a distinct eating disorder.

Nine Studies were included into the meta-analyses to investigate the association between Binge-Eating-Disorder and personality traits in patients presenting with obesity or pre-obesity. The results of the present study indicate that pre-obese or obese people with Binge-Eating-Disorder score higher, on average, on Impulsivity, Perfectionism, Harm Avoidance and Ineffectiveness, not only with regard to people with normal-weight without Binge-Eating-Disorder, but also with regard to pre-obese or obese people without Binge-Eating-Disorder.

Differences between individual studies could be due to sample size. Sample size varies from 33 subjects to 903 subjects. Differences may also be due to the fact that studies did not all use the same instruments to assess personality traits.

5.2 Accordance with other studies

To the knowledge of this author, no other meta-analysis has ever been done regarding the association of Binge-Eating-Disorder and personality traits in obesity and pre-obesity. As such, no comparison can be made with other studies.

On the other hand, the results of the present study are in line with the position of the DSM-5 work-group of eating disorders (www.dsm5.org), which emphasizes the presence of personality disturbance in Binge-Eating-Disorder in terms of *“greater concerns about shape and weight, more personality disturbance, and a higher likelihood of psychiatric comorbidity in the form of mood disorders and anxiety disorders. Also, BED is associated with lower quality of life than obesity.”*

5.3 Accordance with Hypotheses

Hypothesis 1 predicted that pre-obese or obese people with Binge-Eating-Disorder would show different levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and

Reward Dependence than normal-weight people without Binge-Eating-Disorder. This hypothesis was confirmed by the results for five of the six personality traits, namely Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness and Novelty Seeking. Medium to strong effect sizes were found for these five personality traits, meaning that overweight or obese people with Binge-Eating-Disorder showed **higher** levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness and Novelty Seeking than people with normal-weight. Only Reward Dependence showed effect sizes close to null, meaning that it did not differ among the three pairs of comparison.

Hypothesis 2 predicted that pre-obese or obese people with Binge-Eating-Disorder would show different levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence than pre-obese or obese people without Binge-Eating-Disorder. This hypothesis was confirmed by the results for four of the six personality traits, namely Impulsivity, Perfectionism, Harm Avoidance and Ineffectiveness. These four personality traits showed medium effect sizes, meaning that pre-obese or obese people with Binge-Eating-Disorder showed **higher** levels of Impulsivity, Perfectionism, Harm Avoidance and Ineffectiveness than pre-obese or obese people without Binge-Eating-Disorder. Reward Dependence and Novelty Seeking only showed small effect sizes close to null, meaning that they did not differ among the three pairs of comparison.

Hypothesis 3 predicted that there would be no difference between pre-obese or obese people without Binge-Eating-Disorder and people with normal weight, meaning that both groups would show the **same** levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness, Novelty Seeking and Reward Dependence. This hypothesis could only be confirmed for Perfectionism, Harm Avoidance, Novelty Seeking and Reward Dependence. For Ineffectiveness and Impulsivity, there were strong effect sizes, meaning that they did differ between both groups. Obese people without Binge-Eating-Disorder showed higher levels of Impulsivity and higher levels of Ineffectiveness than people with normal-weight.

The three hypotheses were only partly confirmed.

Pre-obese or obese people with Binge-Eating-Disorder show higher levels of Impulsivity, Perfectionism, Harm Avoidance, Ineffectiveness and Novelty Seeking than people with normal-weight, but both groups do not differ on Reward Dependence.

Pre-obese or obese people with Binge-Eating-Disorder show higher levels of Impulsivity, Perfectionism, Harm Avoidance and Ineffectiveness than pre-obese or obese people without Binge-Eating-Disorder, but both groups do not differ on Reward Dependence and Novelty Seeking.

Pre-obese or obese people without Binge-Eating-Disorder show the same levels of Perfectionism, Harm Avoidance, Novelty Seeking and Reward Dependence as people with normal weight. But Pre-obese or obese people without Binge-Eating-Disorder do show higher levels of Ineffectiveness and Impulsivity than people with normal-weight.

5.4 Conflicting Results

Not all studies showed similar effect sizes for the different personality traits. As only nine studies were included into the meta-analyses, only two to four studies were compared regarding each personality trait. This is obviously a small number. As such, any interpretation of differences between studies should be considered with caution. The most prominent conflicting results will be discussed in the following.

Impulsivity

Conflicting results were found for the pair of comparison “BED vs. Pre-Obese/Obese”. Three studies were compared. The studies by Fassino et al. (2003) and Nasser et al. found a strong effect, whereas the study by Davis et al. found an effect close to null. A possible explanation for this difference could be that the study by Davis et al. was the only one of the three studies which included men in their sample.

Perfectionism

Conflicting results were found for the pair of comparison “BED vs. Pre-Obese/Obese”. Three studies were compared. The studies by Molinari et al. and Fassino et al. (2003) found a strong effect, whereas the study by Adami et al. found an effect close to null. A possible explanation for this difference could again be that the study by Adami et al. was the only one of the three studies which included men in their sample.

Ineffectiveness

Conflicting results were found for the pair of comparison “BED vs. Normal-weight”. The two studies found highly conflicting effect sizes. The study by Adami et al. found a small effect size close to null, whereas the study by Fassino et al. (2003) found an extremely strong effect size, leading to a strong overall effect size. A possible explanation for this difference could be that the study by Adami et al. was published in 1996 whereas the study by Fassino et al. (2003) was published seven years later.

Another explanation could be the difference of sample size in the two studies. The sample in Adami et al. included only 63 subjects whereas the sample in Fassino et al. (2003) included 163 subjects.

Conflicting results were also found for the pair of comparison “BED vs. Pre-Obese/Obese”. Two of the three studies found a strong effect size whereas the third study found an effect size close to null. A possible explanation for this difference could be that the study by Adami et al. was the only one of the three studies which included men in their sample.

Novelty Seeking

Conflicting results were found for the pair of comparison “Pre-Obese/Obese vs. Normal-weight”. Two of the three studies found a medium effect whereas the third study found an effect close to null. One possible explanation for this difference could be that the study by Grucza et al., which found an effect size close to null, had a much lower mean BMI (30.95) compared to the mean BMIs found in the other two studies: 38.32 for Fassino (2002) et al. and 37.1 for Davis et al. Another explanation could be the difference in sample size in the three studies. The samples in Fassino et al. (2002) and Davis et al. included 200 and 163 subjects respectively, whereas the study by Grucza et al. included 903 subjects.

5.5 Implications for treatment

As pointed out in 1.1.3 (*Treatment of Binge-Eating-Disorder*), the treatment of Binge-Eating-Disorder is a complex one, since many different factors seem to play a role in its development, maintenance and recovery. Any treatment attempt has to consider both weight and eating-disorder concerns. Treatments such as Interpersonal Therapy, Behavioural Weight Loss Treatment, Cognitive-Behavioural Treatment (CBT), guided self-help based on CBT, Dialectical Behaviour Therapy or medication-only treatments or a combination of both medication and psychotherapy can help to reduce binge eating frequency in the short-term, but are far less promising in the long-term (see in particular Brownley, Berkman, Sedway, Lohr and Bulik, 2007). Most psychological interventions focus on the treatment of the eating-disorder and general psychopathology and not so much on personality traits. Given that the long-term outcome of currently available treatments is far from perfect, additional attention should be paid to specific personality traits that may be involved in the outcome of psychological interventions.

The present study has revealed that there is in fact an association between several specific personality traits and Binge-Eating-Disorder.

Pre-obese or obese individuals with Binge-Eating-Disorder seem to be more impulsive than pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight. This means that they show a tendency to act on cravings and urges rather than reining them in and delaying gratification. Treatment should therefore focus on stopping those urges and developing alternative actions to satisfy them.

Pre-obese or obese individuals with Binge-Eating-Disorder also seem to be more perfectionist than pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight. This means that they show a tendency to set unrealistic standards and to strive to attain those standards. This often ends in an “all-or-none”-thinking. Therefore treatment should focus on reducing self-imposed pressure and on allowing for non-perfectionist actions.

In addition, pre-obese or obese individuals with Binge-Eating-Disorder seem to have more feelings of ineffectiveness than pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight. This means that they have stronger feelings of inadequacy, insecurity, worthlessness and of not having control over their lives. Therefore treatment should focus on building up self-effectiveness and self-esteem in obese persons with Binge-Eating-Disorder.

Furthermore, pre-obese or obese individuals with Binge-Eating-Disorder seem to score higher on Harm Avoidance than pre-obese or obese individuals without Binge-Eating-Disorder and individuals with normal-weight. This means that they worry excessively, are more pessimistic and try to avoid punishment. Again, treatment should focus on building up self-esteem in those individuals, and in helping them to better cope with unpleasant or difficult situations.

Finally, although pre-obese or obese individuals with Binge-Eating-Disorder do not score higher on Novelty Seeking than pre-obese or obese people without Binge-Eating-Disorder, they do score higher on this trait than individuals with normal-weight. This means that they have a tendency to be impulsive, disorderly and quick-tempered. Treatment should therefore try to foster the capacity for deliberation and postponing decision making.

On the whole, the results of the present study point out that any treatment of Binge-Eating-Disorder should give full consideration to the five personality traits described above. This could be

achieved in particular using specific psychological interventions such as strategies of impulse-control, cognitive restructuring, assertiveness-training, coping strategies and relaxation exercises.

Since Binge-Eating-Disorder is often linked to obesity, the results of the present study are also relevant for obese people seeking weight-loss. As already mentioned, a study by de Zwaan (2001) showed that 30% of obese people seeking weight-loss treatment have Binge-Eating-Disorder. Weight-loss programs should therefore not only focus on mere weight-loss, but provide information on Binge-Eating-Disorder as well. This could empower obese people with Binge-Eating-Disorder to effectively fight their weight problem.

5.6 Implications for Binge-Eating-Disorder as a distinct eating disorder

As pointed out in 1.1. *Binge-Eating-Disorder (BED)*, the debate about whether Binge-Eating-Disorder is a distinct eating disorder or not has not been settled once and for all up to now.

It could be argued that the psychopathology attributed to Binge-Eating-Disorder could be due directly to obesity. It is generally admitted that there is a social stigma against obesity in western countries (Stunkard & Wadden, 1992). Already in their childhood obese people make the experience that others have prejudice against them because of their weight, or experience discrimination because of their physic. On the other hand, Grucza, Przybeck and Cloninger (2007) have shown in their study that obese people without Binge-Eating-Disorder do not, on average, exhibit signs of psychological maladjustment. This means that people with Binge-Eating-Disorder are different from other people who have weight problems. In their review on the validity and clinical utility of Binge-Eating-Disorder, Wonderlich, Gordon, Mitchell, Crosby and Engel (2009) pointed out that there is substantial evidence showing that Binge-Eating-Disorder can be differentiated from other existing eating disorders. Individuals with Binge-Eating-Disorder report subjective distress, a significant impairment in quality of life, and show clinical levels of eating disorder psychopathology similar to other eating disorders. These findings support the clinical utility of the diagnosis.

DSM-IV-TR officially recognizes only two eating disorders, namely Anorexia Nervosa and Bulimia Nervosa. Binge-Eating-Disorder is quite different from these disorders. Although it shares several personality characteristics with Anorexia Nervosa and Bulimia Nervosa such as high Perfectionism and Ineffectiveness, it differs however from these disorders in many other ways. In particular,

compensatory behaviour such as purging or extreme physical activity are absent in Binge-Eating-Disorder.

On the other hand, it is less obvious to distinguish Binge-Eating-Disorder from obesity. According to the DSM-5 work-group on eating disorders, Binge-Eating-Disorder can be differentiated from obesity *“in terms of greater concerns about shape and weight, more personality disturbance, and a higher likelihood of psychiatric comorbidity in the form of mood disorders and anxiety disorders. Also, BED is associated with lower quality of life than obesity.”*

As Wonderlich et al. point out in their review, several studies showed that people who engage in binge-eating rate higher on Axis-I and Axis-II mental disorders than people who do not engage in binge-eating. Furthermore, the results of some studies suggest that the presence of comorbid mental disorders is specifically related to their binge eating rather than to their level of obesity. The review also reports a study in which people with Binge-Eating-Disorder, Anorexia Nervosa and Bulimia Nervosa are compared in terms of comorbid mental disorders. Results showed that people with Bulimia Nervosa showed the highest risk for comorbid disorders (94.5%), followed by people with Binge-Eating-Disorders (78.9%). People with Anorexia Nervosa showed the lowest risk for comorbid disorders (56.2%). On the whole, the studies review by Wonderlich et al. “provide evidence that BED patients display significant psychiatric comorbidity (roughly comparable to other eating disorders) that cannot be simply explained by the presence of obesity.” (p. 691).

The results of the present study support the concept of Binge-Eating-Disorder as a distinct entity. In particular, the study has shown that pre-obese or obese people with Binge-Eating-Disorder score higher on the personality traits Impulsivity, Perfectionism, Ineffectiveness and Harm Avoidance than pre-obese or obese people without Binge-Eating-Disorder.

5.7 Limitations

There are some limitations of the present study to be considered, concerning the limitations of meta-analysis as such, and concerning the present meta-analyses in particular.

5.7.1 General Criticism of Meta-Analysis

As Borenstein, Hedges, Higgins and Rothstein (2009) point out, meta-analysis has been widely criticised, especially for its validity. The classic problems of meta-analysis are mentioned briefly below.

Mixing apples and oranges. Meta-Analysis is criticized for statistically combining results from studies measuring different things, for studying different subject populations and for manipulating different variables (Sharpe, 1997). Possible important differences across studies could be ignored by the summary effect. Borenstein et al. respond to this critique by pointing out that “the consistency, and hence generalizability, of findings from one type of study to the next can be assessed formally” (p. 379).

Garbage-in, garbage-out. By including and combining many methodologically low-quality studies, the errors in these studies are carried on by the meta-analysis, hence falsifying the results. Borenstein et al. agree to this critique, but point out that one of the strengths of meta-analysis is “the ability to investigate whether variation in characteristics of studies is related to the size of the effect” (p. 380)

File-drawer-problem. Generally, only significant findings are published. Furthermore, studies finding high treatment effects have a bigger chance to be published than studies finding lower treatment effects, or in other words, studies showing beneficial effects of a new treatment have a higher chance to be published than a study showing no treatment effect. Thus, a meta-analysis could possibly overestimate the magnitude of a treatment effect or even find a treatment effect where none exists. But this problem of publication bias “is a problem for any kind of literature search” (p.379; Borenstein et al, 2009).

And finally, to close the section of classic problems of meta-analysis, it should be taken into consideration that “one number cannot summarize a research field” (Borenstein et al., p. 378), meaning that the analysis focuses on the summary effect and thus ignores the fact that results can vary from study to study.

5.7.2 Criticism and Possible Limitations of the Present Meta-Analyses

The present meta-analyses can be criticized on the following points:

1. The strongest point of criticism regarding the present meta-analyses is that only nine studies were used in it. Most comparisons were based on only two or three studies. As such, the results have to be regarded with caution. On the other hand, the effect sizes resulting from only a few studies were often quite high, in particular for the comparison “BED vs. Normal-weight” concerning Harm Avoidance. The probability to have picked the only four studies that show significant differences is rather low.
2. Only studies published in peer reviewed journals were included. Dissertations found during the search in various internet data bases were excluded from the meta-analyses. This could have led to a file-drawer-problem as mentioned in 5.6.1. Furthermore, only primary sources were considered, meaning that for example reviews without data were not included into the meta-analyses.
3. The final decision which articles to include and which articles to exclude was made by the author alone. If this subjective judgment had been made differently, the result of the meta-analyses could have been different.
4. As mentioned in Chapter 4.5, seven studies had to be excluded because of missing data. Since these meta-analyses were conducted on only nine studies, these seven missing studies could possibly have led to significant changes in the present analysis.
5. The studies of this meta-analyses often used self-administered instruments to diagnose Binge-Eating-Disorder and personality traits. As Striegel-Moore and Franko (2003) pointed out, the use of self-administered instruments can lead to over-reporting of binge eating due to inadequate lay understanding of what constitutes an eating binge. In addition, the assessment of personality traits could have been influenced by social desirability.
6. Using exclusion and/or inclusion criteria (see 3.3 *Study Selection*) for the selection of specific assessment instruments of personality could have allowed for a better comparison of the results of primary studies and could thus have led to a better integration into effect sizes, preventing the above mentioned “Mixing Apples and Oranges” problem. Unfortunately, no single specific instrument had been used for the assessment of personality in Binge-Eating-Disorder in a significant number of studies, so that the present study had to rely on several different instruments, in particular the BIS, the EDI-2 and the TCI.

7. Only three of the nine studies included men in their sample and only one of those three studies included an equal number of men and women. As such, the results cannot be extrapolated to the male population.

5.8 Future Directions

Although Binge-Eating-Disorder will be included in the official part of DSM-5, there is a need to further investigate the disorder, in particular with regard to the personality characteristics that are associated with it.

Up to now, research into Binge-Eating-Disorder has been hampered by the fact that the disorder was not officially recognized and that patient who had binges outside of Bulimia Nervosa had to be classified under “Eating Disorder Not Otherwise Classified” (EDNOS). The fact that Binge-Eating-Disorder will be included as an official eating disorder in DSM-5 will foster research of the disorder in the years to come.

Research into personality characteristics that may be associated with the disorder will also be boosted by the radically new approach to assess and diagnose personality psychopathology that is currently being developed for DSM-5. As stated in the draft criteria for Personality Disorders on the DSM-5 website, the new approach includes *“revised general criteria for personality disorder, the provision for clinicians to evaluate a limited set of personality disorder types according to criteria based on core impairments in personality functioning and pathological personality traits, and an overall measure of the severity of personality dysfunction”*.

Additional research into all aspects of Binge-Eating-Disorder is certainly warranted, all the more since Binge-Eating-Disorder is frequently associated with obesity and that obesity is rapidly becoming one of the major causes of morbidity in the western world. Until now, there are few efficient treatment options – including psychological approaches - to achieve significant and lasting weight loss. Although several psycho-therapeutical approaches have been shown to help people to better deal with Binge-Eating-Disorder, a better knowledge of personality strengths and weaknesses would certainly foster the development of more efficient psychological treatment interventions in this field.

6 Conclusion

Overweight/Pre-obesity and obesity have become a major problem in industrialised countries. They are among the leading preventable causes of death worldwide and have become a major risk factor for numerous morbidities. In addition, they significantly reduce mental and physical health-related quality of life.

In recent years, there has been a growing debate about whether pre-obesity and obesity associated with binge eating (non-purging) should be distinguished from pre-obesity and obesity occurring without binge-eating, and whether a particular type of binge eating, called Binge-Eating-Disorder, should be considered as a disorder of its own. Binge-Eating-Disorder was included among “Eating Disorder Not Otherwise Specified” or EDNOS in the official part of DSM-IV. Although it was included and defined using diagnostic criteria in Appendix B of DSM-IV and has now been proposed to be included as an eating disorder of its own in the forthcoming DSM-5, the controversy surrounding the disorder has not abated.

There is however little evidence on how Binge-Eating-Disorder should be best treated and long-term positive effects of currently available treatments are still missing. A better understanding of what may lead to the disorder or be associated with its occurrence could result in better treatment modalities.

The present study investigated the association between Binge-Eating-Disorder and six personality traits: Impulsivity, Perfectionism, Ineffectiveness, Harm Avoidance, Reward Dependence and Novelty Seeking, in patients presenting with obesity or overweight/pre-obesity. Results suggest that there may be an association between Binge-Eating-Disorder and the first four of the six traits, since pre-obese or obese individuals with Binge-Eating-Disorder score higher on these traits than pre-obese or obese people without Binge-Eating-Disorder.

The findings give support to Binge-Eating-Disorder as a distinct disorder that might be independent from obesity. In addition, these character traits should be given particular attention in future studies investigating the causes and/or accompanying features of obesity as well as in studies examining the effect of psychological, pharmacological or bariatric treatments for pre-obese or obese individuals with Binge-Eating-Disorder seeking weight reduction.

7 References

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8 Appendices

Appendix A – Keyword Combinations

Articles were searched by using the following keyword combinations:

```
bing*4
AND
personality trait*
OR
five-factor-model
OR
big five
OR
Big 5
OR
Neuroticism
OR
Extraversion
OR
Openness
OR
Agreeableness
OR
Conscientiousness
OR
NEO-PI-R
OR
16PF
```

⁴ The asterisk is a so called “wildcard character”, meaning that the search engine will search for all terms that begin with the word which precedes the asterisk: `bing*` → `binge`, `binging`, `binged`, `binge eating disorder`, ...

Appendix B – Coding Scheme for Data Extraction from Primary Sources

Title
Author(s)
Year of Publication
Country
Number of cases ▪ Number of all cases ▪ Binge-Eating / Binge-Eating-Disorder positive ▪ Binge-Eating / Binge-Eating-Disorder negative ▪ People with overweight and Binge-eating / Binge-Eating-Disorder ▪ People with overweight and no Binge-Eating / Binge-Eating-Disorder ▪ People with normal weight and no Binge-Eating / Binge-Eating-Disorder
Age of participants
Gender of participants
Mean BMI
Eating-Disorder Screening Tool used in study
Personality Traits assessed
Personality Screening Tool used in Study
Results ▪ Mean ▪ Confidence Interval ▪ Standard Deviation ▪ Test-Statistics
Comments

Appendix C – Studies and Data Excluded from the Meta-Analyses

The following Exclusion Criteria were used:

- Binge-Eating-Disorder or personality traits only mentioned in the abstract or text but not assessed further in the study
or binge-eating assessed only in connection with Bulimia Nervosa (Binge-Eating-Disorder in connection with bulimia nervosa would not be considered as a disorder on its own) (n = 146; 95 %)⁵
- Subjects under the age of 18 (adolescents and children) (n = 6; 4 %)
- Single case-studies (n = 2; 1 %)
- Language other than English, German or French (n = 0; 0%)

References are in alphabetical order

Study	Exclusion Criteria
1. Abbate-Daga, G., Amianto, F., Rogna, L., & Fassino, S. (2007). Do anorectic men share personality traits with opiate dependent men? A case-control study. <i>ADDICTIVE BEHAVIORS</i> , 32(1), 170–174.	Binge-Eating-Disorder not assessed
2. Abbate-Daga, G., Gramaglia, C., Amianto, F., Marzola, E., & Fassino, S. (2010). Attachment Insecurity, Personality, and Body Dissatisfaction in Eating Disorders. <i>JOURNAL OF NERVOUS AND MENTAL DISEASE</i> , 198(7), 520–524.	Binge-Eating-Disorder not assessed
3. Abbate Daga, G., Gramaglia, C., Bailer, U., Bergese, S., Marzola, E., & Fassino, S. (2011). Major depression and avoidant personality traits in eating disorders. <i>PSYCHOTHERAPY AND PSYCHOSOMATICS</i> , 80(5), 319–320.	Binge-Eating-Disorder not assessed
4. Abbate-Daga, G., Pierò, A., Gramaglia, C., Gandione, M., & Fassino, S. (2007). An attempt to understand the paradox of anorexia nervosa without drive for thinness. <i>PSYCHIATRY RESEARCH</i> , 149(1-3), 215–221.	Binge-Eating-Disorder not assessed
5. Adami, G. F., Bressani, A., & Marini, P. (1998). Body image alterations in binge eating disorder. <i>The Canadian Journal of Psychiatry / La Revue canadienne de psychiatrie</i> , 43(10), 1052–1053.	Binge-Eating-Disorder not assessed
6. Anderluh, M., Tchanturia, K., Rabe-Hesketh, S., Collier, D., & Treasure, J. (2009). Lifetime course of eating disorders: Design and validity testing of a new strategy to define the eating disorders phenotype. <i>PSYCHOLOGICAL MEDICINE</i> , 39(1), 105–114.	Binge-Eating-Disorder not assessed
7. Andersen, A. E. (1999). Medical information for nonmedical clinicians and educators treating patients with eating disorders: Psychotherapists, educators, nutritionists, experiential therapists, coaches: Eating disorders: A guide to medical care and complications. (Berg, B. French Lemberg Schreiber Sundgot-Borgen Szmulker Treasure, Ed.). Baltimore, MD, US: Johns Hopkins University Press; US.	Binge-Eating-Disorder not assessed
8. Antonini, A., & Cilia, R. (2009). Behavioural adverse effects of dopaminergic treatments in parkinsons disease: Incidence, neurobiological basis, management and prevention. <i>Drug Safety</i> , 32(6), 475–488.	Binge-Eating-Disorder not assessed
9. Anzengruber, D., Klump, K. L., Thornton, L., Brandt, H., Crawford, S., Fichter, M. M., ... (2006). Smoking in eating disorders. <i>EATING BEHAVIORS</i> , 7(4), 291–299.	Binge-Eating-Disorder not assessed
10. Atwell, K., Abraham, C., & Duka, T. (2011). A Parsimonious, Integrative Model of Key Psychological Correlates of UK University Students' Alcohol Consumption. <i>ALCOHOL AND ALCOHOLISM</i> , 46(3), 253–260.	Binge-Eating-Disorder not assessed
11. Auerbach-Barber, S. (1998). Interpersonal and personality correlates of obese binge eaters and nonbinge eaters. <i>Dissertation Abstracts International: Section B: The Sciences and Engineering</i> , 59(3-B), 1357.	Binge-Eating-Disorder not assessed

⁵ the numbers and percentages of all excluded studies

12. Baker, J. H., Mazzecii, S. E., & Kendler, K. S. (2007). Association between broadly defined bulimia nervosa and drug use disorders: Common genetic and environmental influences. <i>INTERNATIONAL JOURNAL OF EATING DISORDERS</i> , 40(8), 673–678.	Binge-Eating-Disorder not assessed
13. Bernardini, L. de, & Innamorati, M. (2007). Psychiatric comorbidity in the frail patient. <i>Archives of Gerontology and Geriatrics</i> , 44(SUPPL), 139–142.	Binge-Eating-Disorder not assessed
14. Bernstein, J., Graczyk, A., Lawrence, D., Bernstein, E., & Strunin, L. (2011). Determinants of Drinking Trajectories Among Minority Youth and Young Adults: The Interaction of Risk and Resilience. <i>YOUTH & SOCIETY</i> , 43(4), 1199–1219.	Binge-Eating-Disorder not assessed
15. Berrios-Hernandez, M. N., Rodríguez-Ruiz, S., Perez, M., Gleaves, D. H., Maysonet, M., & Cepeda-Benito, A. (2007). Cross-cultural assessment of eating disorders: Psychometric properties of a Spanish version of the Bulimia test-revised. <i>EUROPEAN EATING DISORDERS REVIEW</i> , 15(6), 418–424.	Binge-Eating-Disorder not assessed
16. Birkley, E. L., & Smith, G. T. (2011). Recent advances in understanding the personality underpinnings of impulsive behavior and their role in risk for addictive behaviors. <i>Current Drug Abuse Reviews</i> , 4(4), 215–227.	Binge-Eating-Disorder not assessed
17. Bloks, H., Hoek, H. W., Callewaert, I., & van Furth, E. (2004). Stability of personality traits in patients who received intensive treatment for a severe eating disorder. <i>JOURNAL OF NERVOUS AND MENTAL DISEASE</i> , 192(2), 129–138.	Binge-Eating-Disorder not assessed
18. Bobbitt, P. E. (2004). Temperament and alcohol use: The relationship to psychological reactance. <i>Dissertation Abstracts International: Section B: The Sciences and Engineering</i> , 65(3-B), 1594.	Binge-Eating-Disorder not assessed
19. Bollen, E., & Wojciechowski, F. L. (2004). Anorexia nervosa subtypes and the big five personality factors. <i>EUROPEAN EATING DISORDERS REVIEW</i> , 12(2), 117–121.	Binge-Eating-Disorder not assessed
20. Boyd, C., Abraham, S., & Kellow, J. (2005). Psychological features are important predictors of functional gastrointestinal disorders in patients with eating disorders. <i>SCANDINAVIAN JOURNAL OF GASTROENTEROLOGY</i> , 40(8), 929–935.	Binge-Eating-Disorder not assessed
21. Braet, C. (2005). Psychological profile to become and to stay obese. <i>International Journal of Obesity</i> , 29(SUPPL. 2), S19.	Subjects were under the age of 18
22. Brown, T. A., Haedt-Matt, A. A., & Keel, P. K. (2011). Personality Pathology in Purging Disorder and Bulimia Nervosa. <i>INTERNATIONAL JOURNAL OF EATING DISORDERS</i> , 44(8), 735–740.	Binge-Eating-Disorder not assessed
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98. Mitchell, K. S., Mazzeo, S. E., Aggen, S. H., Maes, H. H., Kendler, K. S., Neale, M. C., & Bulik, C. M. (2008). Characteristics of monozygotic male and female twins discordant for overweight: A descriptive study. <i>EATING BEHAVIORS</i> , 9(3), 366–369.	Binge-Eating-Disorder not assessed
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107. Nunez-Navarro, A., Jimenez-Murcia, S., Alvarez-Moya, E., Villarejo, C., Diaz, I. S., Augmantell, C. M., ... (2011). Differentiating Purging and Nonpurging Bulimia Nervosa and Binge Eating Disorder. <i>INTERNATIONAL JOURNAL OF EATING DISORDERS</i> , 44(6), 488–496.	Binge-Eating-Disorder not assessed
108. O'Mahony, J. F., & HOLLWEY, S. (1995). The correlates of binge eating in two nonpatient samples. <i>Addictive behaviors</i> , 20(4), 471–480.	Binge-Eating-Disorder not assessed
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Zusammenfassung

Hintergrund und Kontext

Die Binge-Eating-Störung tritt verbreitet bei Patienten auf welche adipös oder übergewichtig/prä-adipös sind. Der Ursprung der Binge-Eating-Störung wie auch ihre Assoziation mit Persönlichkeitsmerkmalen bleibt jedoch nur schwer fassbar. Eine Verbindung zwischen beiden zu bestätigen wäre von größter Bedeutung für all diejenigen die im Bereich der Essstörungen wie auch im Bereich der Adipositas arbeiten.

Ziel

Das Ziel dieser Arbeit war es nach einer Assoziation zwischen Binge-Eating-Störung und spezifischen Persönlichkeitsmerkmalen in Individuen mit Adipositas oder Übergewicht/prä-Adipositas zu suchen. Um dieses Ziel zu erreichen, wurden Studien welche mögliche Beziehungen zwischen diesen Elementen untersuchen kritisch überprüft und zusammengefasst.

Datenauswahl und Synthese

Bei dieser Arbeit handelt es sich um eine systematische Suche welche den allgemeinen Richtlinien des PRISMA-Statements (Preferred Reporting Items for Systematic reviews and Meta-Analysis) folgt um systematische Reviews durchzuführen und vorzulegen. Anschließend wurden mit Hilfe der Software Comprehensive Meta-Analysis version 2 (CMA v2.2.030) (BioStat, Inc, Englewood, NJ) Meta-Analysen bei neun Studien durchgeführt. Der Schwerpunkt der Meta-Analysen lag auf drei Vergleichsgruppen, nämlich "prä-adipös/adipös mit BED vs. Normal-gewichtig ohne BED", "Prä-adipös/adipös mit BED vs. Prä-Adipös/Adipös ohne BED" und "Prä-Adipös/Adipös ohne BED vs. Normal-gewichtig ohne BED", bei sechs Persönlichkeitsmerkmalen: Impulsivität, Perfektionismus, Schadensvermeidung, Ineffektivität, Belohnungsabhängigkeit und Neugierverhalten. Es entstanden 52 spezifische Gruppenvergleiche.

Ergebnisse

Der erste Vergleich zeigte, dass prä-adipöse oder adipöse Menschen mit Binge-Eating-Störung höhere Werte als Menschen mit einem normalen Gewicht ohne Binge-Eating-Störung auf fünf der sechs Persönlichkeitsmerkmale erzielten, nämlich Impulsivität, Perfektionismus, Schadensvermeidung, Ineffektivität und Neugierverhalten. Der zweite Vergleich zeigte, dass prä-adipöse oder adipöse Menschen mit Binge-Eating-Störung höhere Werte als prä-adipöse oder adipöse Menschen ohne Binge-Eating-Störung auf vier der sechs Persönlichkeitsmerkmale erzielten,

nämlich Impulsivität, Perfektionismus, Schadensvermeidung und Ineffektivität. Der dritte Vergleich zeigte, dass prä-adipöse oder adipöse Menschen ohne Binge-Eating-Störung höhere Werte als Menschen mit einem normalen Gewicht ohne Binge-Eating-Störung auf zwei der sechs Persönlichkeitsmerkmale erzielten, nämlich Impulsivität und Ineffektivität.

Schlussfolgerung

Die Ergebnisse dieser Studien unterstützen die Annahme der Binge-Eating-Störung als eine eigenständige Störung, welche möglicherweise unabhängig von Adipositas ist. Sie zeigen darauf hin, dass bei der Behandlung von Binge-Eating-Störung die folgenden Persönlichkeitsmerkmale berücksichtigt werden sollten: Impulsivität, Perfektionismus, Schadensvermeidung, Ineffektivität und Neugieverhalten. Dabei könnten bestimmte psychologische Interventionen zum Einsatz kommen, insbesondere Strategien der Impulskontrolle, kognitive Umstrukturierung, Training der Durchsetzungsfähigkeit, Coping Strategien und Entspannungsübungen. Diesen Persönlichkeitsmerkmalen sollte besondere Aufmerksamkeit geschenkt werden, insbesondere in Studien welche sich mit den Ursachen und/oder den Begleitmerkmalen von Adipositas befassen, oder Studien, welche die Ergebnisse von psychologischen, pharmazeutischen oder bariatrischen Behandlungen von Menschen mit Übergewicht oder Adipositas in Verbindung mit Binge-Eating-Störung, welche einen Gewichtsverlust anstreben, untersuchen.

Stichwörter: Binge-Eating-Störung, prä-Adipositas, Übergewicht, Adipositas, Persönlichkeitsmerkmale.

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2007	„Examen de fin d'études secondaires“ (Matura), Luxemburg
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Berufserfahrung

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Sprachkenntnisse

Luxemburgisch	Muttersprache
Deutsch	fließend in Wort und Schrift
Französisch	fließend in Wort und Schrift
Englisch	fließend in Wort und Schrift
Spanisch	Noch lernend