Overlooked: The Relationship Between Disordered Eating Behaviors and Metabolic Disorders in Adults[1]

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Abstract

Background: Metabolic disorders (i.e., metabolic syndrome, type 1 and type 2 diabetes, and polycystic ovarian syndrome; PCOS) are rising to epidemic proportions. Many severe symptoms and impaired behaviors are associated with metabolic disorders, but often overlooked is the relationship between metabolic disorders and disordered eating behaviors.

Objective: The purpose of this brief report is to describe the extant literature on the relationship between disordered eating behaviors and metabolic disorders, identify the current gaps in research, highlight future areas of study, and provide recommendations for treatment.

Methods: A literature search was conducted in the PsychINFO, ScienceDirect, and PubMed Central databases. The search resulted in 35 articles, published in English. Articles were organized by highlighting the biological nature and behaviors involved in disordered eating, the temporal nature of the relationship between metabolic disorders and eating behaviors, and current treatment options.

Results: The biological and behavioral components of disordered eating behaviors, like stress, food restriction, and palatable foods' addictiveness, help to explain this relationship. Type 1 diabetes, type 2 diabetes, metabolic syndrome, and PCOS are associated with disordered eating behaviors. Current treatment options center around intuitive eating and cognitive behavioral therapy.

Conclusion: Disordered eating behaviors are common in various metabolic disorders, yet remain overlooked as contributing factor to worsening these conditions. Additionally, there are limited treatment options for patients who experience both of these disorders. Increased research is urgently needed to achieve secondary prevention of these conditions and understand the mechanism of actions of treatment for each disorder.

Keywords: metabolic disorders, disordered eating, binge eating, type 1 diabetes, type 2 diabetes, polycystic ovary syndrome, metabolic syndrome

Overlooked: The Relationship Between Disordered Eating Behaviors and Metabolic Disorders in Adults

Diabetes and other metabolic disorders are potentially fatal conditions that are continuing to be diagnosed in alarming numbers. Both obesity and metabolic disorders are continuing to rise to epidemic like conditions (Heindel et al., 2017). Metabolic disorders occur when a component of a patient's metabolism is not working correctly due to abnormal chemical reactions (National Institute of Health U.S. National Library of Medicine, 2019). Breakdown of molecules or cell functions can be affected as well as the dysfunction of some organs. Because metabolic syndrome involves metabolism, diet change is often recommended along with other accompanying treatments. Drastically changing one's diet may cause an individual to adjust known eating habits to maintain a new, more rigid diet (Wansink, 2002). Researchers have recently examined the connection between individuals with metabolic disorders and the development of disordered eating habits (engaging in some symptoms of an eating disorder, however not to the extent that they meet criteria to be diagnosed) and diagnosable eating disorders (Broadley et al., 2020; Gagnon et al., 2017; Hudson et al., 2010; Lee et al., 2018; Nip et al., 2019). Disordered eating behaviors refer to behaviors that are often listed as criteria for an eating disorder (self-worth based on body shape or size, strict and excessive exercise routine, obsession with food, eating vast amounts of food in one sitting, eating food in secret; von Ranson et al., 2005). However, someone is categorized as having disordered eating behaviors rather than an eating disorder if their symptoms do not match the exact DSM-5 criteria for an eating disorder (von Ranson et al., 2005). There are many metabolic disorders; however, the primary conditions addressed in this review are type 1 diabetes, type 2 diabetes, polycystic ovary syndrome (PCOS), and metabolic syndrome, as these conditions have a higher known prevalence of disordered

eating behaviors (Broadley et al., 2020; Lee et al., 2018; McCuen-Wurst et al., 2017), which will be described in this review. Metabolic conditions have severe symptoms such as high blood pressure, increased risk of heart disease, and high and low blood cholesterol (Lee et al., 2014), and disordered eating habits have the potential to exacerbate these symptoms. However, comprehensive assessment and understanding of disorders eating behaviors is not typically a common practice in the treatment of and research for metabolic disorders, potentially limiting the reach and long-term effectiveness of current treatments for metabolic disorders. It is vital to determine if specific aspects of the accompanying symptoms, treatment, or something else entirely are tied to disordered eating habits to improve the quality of life for patients with metabolic disorders. Increased research is needed to determine the mechanisms by which disordered eating behaviors exacerbates symptoms in patients with metabolic syndrome.

The purpose of this brief report is to describe the current literature regarding disordered eating and metabolic disorders. This report will focus on the biological and behavioral components of disordered eating behaviors, specifically binge eating, and how they may relate to metabolic disorders. It will also review the research on the temporal relationship between disordered eating and metabolic disorders. Additionally, current treatment options will be described. Finally, the report will highlight recommendations for future directions regarding treatment options and further research.

Methods

This report was driven by the following research questions:

- How does the biology and behaviors of disordered eating relate to factors of metabolic disorders?

- What are the statistics of behaviors associated with eating disorders in patients with metabolic disorders and what explanations does the research offer for this relationship?
- What are the current treatment options for patients with disordered eating and metabolic disorders?

To find substantial literature to answer these research questions the authors completed a targeted search of the literature via PsychINFO, ScienceDirect, and PubMed Central using search terms such as disordered eating and metabolic disorders, binge eating biology, metabolic disorders and binge eating treatments, and binge eating treatments. Only peer-reviewed journal articles available in English were included. To answer the research questions above, the authors reviewed 35 articles. These articles are organized by the biological and behavioral components of binge eating, disordered eating and metabolic disorders, and current treatment options.

What We Know about the Relationship between Disordered Eating and Metabolic Disorders

The following will describe the current available literature on the relationship between disordered eating and metabolic disorders, specifically the overlapping of behavioral and biological components between both conditions, as well as the prevalence and common features of disordered eating behaviors in metabolic syndrome, type 1 diabetes, type 2 diabetes, and polycystic ovarian syndrome. We will then end with treatment options currently available and discuss the need for future research.

Behavioral and Biological Components

Western cultures commonly misunderstand disordered eating behaviors and diagnosable eating disorders. Disordered eating behaviors refers to behaviors that are often listed as criteria for an eating disorder (self-worth based on body shape/size, strict and excessive exercise routine, obsession with food, eating vast amounts of food in one sitting, eating food in secret; von Ranson et al., 2005), whereas diagnosable eating disorders refers to anorexia nervosa, bulimia nervosa, and binge eating disorder (American Psychiatric Association, 2013). The most significant type of disordered eating behavior found in patients with metabolic disorder is binge eating symptoms, (Broadley et al., 2019; McCuren-Wurst et al., 2019; Lee et al., 2018; Hudson et al., 2010). For example, people with type 2 diabetes are around 1.4%- 25.6 % likely to also have binge eating disorder (BED) with a greater chance of having BED if they have a higher body max index (McCuren-Wurst et al., 2019). A ‘binge’ refers to eating an amount of food most would consider large with a sense of loss of control (Mathes et al., 2009). This type of disordered eating behavior does not relate to the restriction behaviors seen in anorexia nervosa (American Psychiatric Association, 2013). There are two diagnosable DSM-5 eating disorders which involve binge eating: Binge Eating Disorder (BED) and Bulimia Nervosa. However, you can also have binge related disordered eating behaviors which may not meet the classification for an eating disorder, such as binge eating occurring once every two weeks rather than occurring once a week for a three-month period which is needed to meet the diagnostic criteria (American Psychiatric Association, 2013). Binge eating is a behavior commonly observed in patients with metabolic disorders and can be exacerbated by both biological and physiological factors (McCuren-Wurst, 2018). Nevertheless, the significance of this behavior, not just in patients with metabolic disorders, should be considered a public health crisis because of its comorbidity with obesity and

depression (Mathes et al., 2009). Examining the biological and behavioral components, specifically stress, food restriction, and addictiveness of palatable foods, of binge eating allows for a greater understanding of the complexity of this behavior and potential indications for effective treatment.

For food consumption to be considered a "binge," there must be a private consumption of vast amounts of food quickly (Mathes et al., 2009). The eating does not occur because of hunger or metabolic need but instead occurs to gain a sense of control or comfort. Stress plays a large role in this relationship. Stress is often an initial contributor to binge eating behavior and/or the biological soothing effect that occurs when one engages in binge eating. Individuals with BED have been shown to participate in binging behaviors when perceived stress levels and the number of stressful events is elevated (Striegel-Moore et al., 2007). This data indicates that stress contributes to the desire to binge. Patients diagnosed with eating disorders continue their disordered eating habits for longer when they maintain stress and dieting (Crowther et al., 2001). Stress and diet tracking are two factors that accompany a metabolic condition diagnosis and thus may be contributing to the prevalence of disordered eating behaviors in these patients. More research needs to be done, however, to be able to determine this relationship. A potential part of optimizing treatment for binge eating behaviors is stress management (Clyne & Blampied, 2004).

Food restriction also contributes to binge related behaviors. Studies with rats have shown that when a rigid and restrictive diet is implemented where the rats receive only 66% of their needed calories, they will eat 42% more food when given free access than rats whose diets were not interfered with (Hagan et al., 2003). It cannot be assumed that animal studies exactly predict results in human participants, but this data helps to display that restriction of food could be

contributing to binging behaviors. A specific study done with young adults displayed that after one-year, strict diet regulations predicted disordered eating behaviors (Allen et al., 2008). This finding has specific importance to patients diagnosed with metabolic conditions because a large part of their treatment is implementing a new and strict diet. While a new, hopefully, more healthy diet is intended to aid these patients, this data suggests that it could be contributing to the development of harmful eating behaviors.

When foods are categorized as highly delicious and highly dangerous (high fat and sugar content) and made to be forbidden, individuals are much more likely to engage in a binge when consuming these kinds of foods (Polivy, 1996). Some individuals diagnosed with metabolic conditions might believe that the foods they used to enjoy are forbidden or restricted after a diagnosis. From Polivy's (1996) article, it could be hypothesized that this labeling of some food as 'bad' could be in some way contributing to binging behaviors. Excessive consumption of palatable foods can lead to metabolic disorder complications of hyperglycemia (Dedoussis et al., 2007). However, the management of consumption of high glycemic foods may be very complicated. Highly palatable foods can trigger dependence and withdrawal symptoms if removed, similar to that of drugs of abuse (Avena, 2007). Foods and beverages high in fat and sugar activate the same reward pathway in the brain of individuals who have engaged in drug abuse. The dopamine neurotransmitters are affected by a binge of highly palatable foods in a similarly way as they are affected by abuse of illicit drugs (Mathes et al., 2009). This data suggests that similar neurobiology occurs in drug addiction and high fat and sugar food consumption, indicating an addiction component to binge eating. So merely introducing a new diet or telling patients not to consume their regular highly palatable foods is not enough to help successfully stop the consumption. Individuals who say they binge on highly palatable foods

should be given additional resources to increase treatment effectiveness. This knowledge is especially relevant to patients with a metabolic disorder or at risk for developing one because of the physical complications associated with eating high fat and sugar content food in vast amounts.

Disordered Eating in Metabolic Conditions

Metabolic Syndrome

Metabolic syndrome is a metabolic disorder that encompasses many risk factors involving an increased risk of heart disease, dyslipidemia, diabetes, and additional cardiovascular issues (McCuen-Wurst et al., 2017). This syndrome can be considered an umbrella diagnosis for individuals who have metabolic related symptoms (i.e, abdominal obesity, glucose intolerance, high blood pressure, and high and low blood cholesterol; Lee et al., 2014). Receiving a BED diagnosis acts as a risk factor for metabolic syndrome, apart from the effects of obesity (McCuen-Wurst et al., 2017). Another study that illustrates the potential links between BED and metabolic syndrome showed that participants who were obese and received a BED diagnosis had two times the chance of developing a new diagnosis of dyslipidemia, a symptom of metabolic syndrome, compared to a match sample without BED (Hudson et al., 2010). Researchers hypothesize that this relationship between metabolic syndrome and binge eating behaviors could be due to the dysfunctional eating behaviors expressed by those diagnosed with BED (Roehrig et al., 2009). Despite these known relationships, there is little research regarding the specifics of why individuals who are diagnosed with metabolic syndrome engage more frequently in disordered eating behaviors. More research should be dedicated to this relationship specifically to help develop treatment aspects that address these issues.

Type 1 Diabetes

Type 1 diabetes is an autoimmune reaction where the body attacks its own beta cells, which produce insulin, resulting in lower insulin levels which affects blood glucose (Diabetes Resources, 2016). Disordered eating behaviors in type 1 diabetes have significantly more research than the other metabolic disorders discussed in this paper. The prevalence of disordered eating behaviors in type 1 diabetes varies, depending on the population under study. For girls, the prevalence ranges from 10.3 - 7.4% for boys, the prevalence is around 1.4% (Neumark-Sztainer et al., 2010). Most research has been dedicated to the understanding of Bulimia Nervosa in type 1 diabetes, like the behavior of insulin omission or underdosing of insulin being utilized as a purging behavior (Broadley et al., 2019). When glucose is not administered, additional calories are excreted via the patient's urine resulting in weight loss (Starkey & Wade, 2010). By not administering insulin correctly, patients are at an increased risk of retinopathy and kidney and nerve damage. Rydall et al. (1997) found that 14% of mid-adolescent girls and 34% of older adolescences and young adults diagnosed with type I diabetes engage in purposeful insulin omission for weight loss.

Why are disordered eating behaviors so common in type 1 diabetes patients? Implementing a restrictive diet intended to help improve symptoms associated with the diagnosis often appears to have the opposite effect (Starkey & Wade, 2010). A restrictive diet encourages a sense of less control and predicts binge eating and purging behaviors. Some individuals engage in binging, purging, and other disordered eating behaviors (eating large quantities of food, obsessing over which food to eat, etc.) because it gives them something to control. Often before being diagnosed with type 1 diabetes, patients tend to have lower than average body mass index (BMI). However, once diagnosed and patients receive regular insulin treatment, there is a rapid

weight gain (Starkey & Wade, 2010). This change in body weight leads to increased body dissatisfaction and increased desire for thinness (Steel et al., 1989) as well as increased distress and stress levels, placing patients with type 1 diagnosis and disordered eating behaviors in a vulnerable position to being diagnosed with a chronic metabolic disorder.

Type 2 Diabetes

Compared to the experience of disordered eating in type 1 diabetes, there is a dearth of literature on the relationship of disordered eating in type 2 diabetes. Type 2 diabetes differs from type 1 diabetes in that it is not an autoimmune response, however a person's body does not produce enough insulin to properly manage blood glucose levels, resulting in high sugar content in the bloodstream (Mayo Clinic, 2020). The cause for type 2 diabetes is unknown, however it is believed to be related to weight, age, low physical activity, and genetics (Diabetes Resources, 2016). Fifty percent of young adults with type 2 diabetes self-report engaging in disordered eating behaviors (Nip et al., 2019). Although there is less research on type 2 diabetes compared to type 1, only 21% of type 1 diabetes patients admitted they engaged in disordered eating behaviors. Type 2 diabetes patients may be more willing to self-admit to disordered eating behaviors because of the focus on weight management and individual responsibility that coincide with a type 2 diabetes management (Gagnon et al., 2017). BED, the DSM-5 diagnosis for dysfunctional and distressing binge eating, is independently associated with a chronic diabetes diagnosis (McCuren-Wurst et al., 2019). Diagnosis of BED increases as the BMI of type 2 diabetes patients increases. The relationship between these two diagnoses is unclear, and future research should be dedicated to this issue. However, it can be deduced that patients who received a type 2 diabetes diagnosis are at risk of developing or engaging in disordered eating behaviors.

Research dedicated to the relationship between type 2 diabetes and disordered eating is much less extensive than that done regarding type 1 diabetes, despite the increased report of disordered eating behaviors (Broadley et al., 2019). The risk factors associated with disordered eating in type 2 diabetes are very similar to type 1 diabetes. Broadley et al. (2019) suggest that insulin-related weight gain, accessibility of purging via insulin omission, and loss of control due to a chronic illness can increase the possibility of developing an eating disorder. Hypoglycemia has been shown to increase the desire to binge and over-insulinization leading to weight gain. Both could contribute to developing disordered eating behaviors. Considering that one in ten individuals are diagnosed with type 2 diabetes (Centers for Disease Control and Prevention, 2020), increased research in the relationship of disordered eating and type 2 diabetes is urgently needed, specifically the mechanisms by which disordered eating develops in patients with type 2 diabetes as well as worsen the disease process.

PCOS

PCOS is a metabolic condition diagnosed in reproductive age women who have oligomenorrhea, hyperandrogenism, and polycystic-appearing ovaries (Lee et al., 2018). PCOS affects up to 21% of women and is often underdiagnosed due to the complex psychological, metabolic, and reproductive features associated with PCOS (Azziz et al., 2016). Further, PCOS phenotypically varies in women depending on racial/ethnic background (Azziz et al., 2016). Insulin resistance and hyperandrogenism are believed to be etiological factors for PCOS and women with PCOS are at an increased risk for type 2 diabetes and obesity (Azziz et al., 2016) Further, women with PCOS often report poor body image concerns due to the clinical features associated with hyperandrogenism, such as hirsutism and acne (Azziz et al., 2016). As such, women diagnosed with PCOS score significantly higher than a control group reporting three

times the likelihood of developing an eating disorder (Lee et al., 2018). Specifically, these women are more likely to be diagnosed with Bulimia Nervosa or BED. These patients also have increased disordered eating behaviors (Lee et al., 2018). To complicate this picture, women diagnosed with PCOS have higher rates of other psychiatric disorders like anxiety, depression, bipolar disorder, and obsessive-compulsive disorder (Brutocao et al., 2018). While the emerging research highlights the significant relationship between disorder eating behaviors and PCOS, there is very little research regarding PCOS and disordered eating. This is likely due to the fact that PCOS itself is often unrecognized (Balen, 2017). These studies suggest that disordered eating habits are closely linked to PCOS diagnosis as many women have increased weight gain and lifestyle modifications are a necessary treatment component. Future research should be dedicated to examining this relationship, specifically the temporal nature of disordered eating and PCOS.

Treatments

The commonality of disordered eating and metabolic disorders highlights the necessity of including food and eating reeducation as part of prescribed treatment for these disorders. Multidisciplinary treatments are often recommended for treatment for patients with metabolic disorder and disordered eating. For extreme BED cases, the first Food and Drug Administration (FDA) approved drug therapy, Vyvanse, has been shown to help patients decrease the risk of relapsing after other treatments (Hudson et al., 2017). Also, naloxone has been shown to decrease the desire to consume highly palatable foods for individuals who engage in Bulimia Nervosa and BED symptoms (Mathes et al., 2009). However, there has not yet been research indicating if these medications have complications with certain metabolic disorders. These two

drug therapies could help manage eating disorder symptoms that impact the patient's physical health precisely due to their metabolic disorder, but additional clinical trials are needed to determine the efficacy of these drug therapies and if they are effective for specific metabolic disorder. However, most times, drug therapy is more effective when combined with additional psychotherapy or treatment.

The recommended evidence-based psychotherapy for individuals with disordered eating behaviors is cognitive-behavioral therapy (CBT; McCuen-Wurst, 2019). Typically, a CBT therapist will utilize the restraint model, hypothesizing that food restrictions occur because of eating, shape, and weight concerns. By addressing the unhelpful cognitions that are typically centered around eating, shape, and weight that trigger binge eating, therapists can help establish healthier eating patterns and develop helpful thoughts and attitudes towards eating, shape, and weight concerns (Wilson, 2011). CBT is effective for helping patients who have binge eating tendencies, which may be related to a metabolic disorder diagnosis, but there is not a specified CBT treatment for binge eating and metabolic disorder management. Although the extant literature demonstrates that CBT is efficacious for treating depression, anxiety, and quality of life for patients with PCOS and/or type 2 diabetes (Jiskoot et al., 2017), only one study to date found that CBT delivered in a guided self-help format is feasible to address lifestyle and disordered eating behaviors in women with type 2 diabetes (Vela et al., 2021). Future research, however, should examine the effect of CBT therapy as well as third wave behavioral therapies, such as Dialectical Behavior Therapy and Acceptance and Commitment Therapy on disordered eating behaviors in patients with metabolic disorders. In addition to CBT, intuitive eating has been shown to improve disordered eating behaviors. Intuitive eating is an eating philosophy that encourages the consumption of food in response to an individual physiological hunger and

satiety cues (vs. emotional or external cues), having a strong connection to be able to acknowledge these cues, and understanding the value or purpose of different foods depending on the context (Linardon & Mitchell, 2017). This change of relationship to food has been shown to have a very positive impact on a variety of individuals. Engaging in intuitive eating practices predicts lower levels of negative body image and disordered eating behaviors than a flexible and rigid diet (Linardon & Mitchell, 2017). The specific quality of not viewing diet as a dichotomous variable (not viewing a diet as either good or bad, healthy or junk, etc.) is credited as the reason why intuitive eating is a protective factor against disordered eating behaviors (Linardon & Mitchell, 2017). Even though research has not indicated the causal relationship between disordered eating and metabolic disorders, incorporating education of intuitive eating techniques into treating individuals diagnosed with metabolic disorders could help minimize this link. Additional research should be dedicated to this idea. As an example, Miller et al (2014) introduced a mindful eating intervention to participants with type 2 diabetes, and after three months these participants displayed marked improvements in diabetes self-management and mindfulness. This study showcases how intuitive eating may be a helpful tool for the management of disordered eating and metabolic disorders.

Clear from the research mentioned is how food restriction can increase binge behaviors (Mathes et al., 2009). Unfortunately, accompanying most diagnoses of a metabolic disorder is a new strict diet. A part of this diet encourages the avoidance of high palatable foods. Because of the addictive qualities of high palatable foods, merely asking someone to begin a new diet consuming less palatable foods is not an effective strategy and has been proven to lead to depression like symptoms and withdrawal induced negative emotional state in animal studies (Lemolo et al., 2012). Also, introducing and potentially encouraging food restriction strategies

can directly put a patient at risk for developing disordered eating habits and could lead to enough distress and dysfunction to be diagnosed as an eating disorder. Herein lies the Catch-22. A part of managing a metabolic disorder is the adjustment of diet not to exacerbate specific symptoms. However, too strict of a diet has been shown to encouraged disordered eating behaviors. Thus, a part of the treatment that needs to be specially tailored to individuals diagnosed with both metabolic and disordered eating behaviors is a diet management that is not restrictive. CBT and intuitive eating are both strategies that offer more benefits to metabolic disorder patients with disordered eating behaviors than prescribing a restrictive diet. Some strategies from the field specifically tailored to diabetes related eating behaviors are eating mindfully, staying physically active, finding alternative activities to eating, and seeking additional support socially or professionally (Vela & Phimphasone-Brady, 2020). These alternative functions help change a person's relationship with food, rather than introducing a new restrictive diet that takes away more of the individual's control. Based on the literature it is clear that specifically tailored disordered eating interventions are needed for patients diagnosed with a metabolic disorder.

Conclusion

The metabolic disorders type 1 diabetes, type 2 diabetes, PCOS, and metabolic syndrome, have been linked to disordered eating behaviors, especially binge eating. Binge eating is a complex behavior that is impacted by biological components related to stress, food restriction, and the addictive quality of highly palatable food (Mathes et al., 2009). The potential risk for type 1 and type 2 diabetes patients to engage in disordered eating behaviors is insulin-related weight gain, loss of control due to being diagnosed with a chronic metabolic disorder, and the accessibility of purging via insulin omission (Broadley et al., 2019). Women diagnosed with

PCOS and individuals diagnosed with eating disorders both have higher rates of anxiety and depression, which could explain the link between these disorders (Lee et al., 2018). Being diagnosed with BED is a risk factor for developing metabolic syndrome, potentially because of the disordered eating habits that accompany a BED diagnosis (McCuen-Wurst et al., 2019). From this research, it is clear that disordered eating and metabolic disorders are related, but more research is needed to discover specific risk factors and investigate whether the disordered eating behavior precedes or is a consequence of these metabolic disorders. Identifying these risk factors will allow for a much more targeted treatment plan and a potentially more efficient path to improve a patient's quality of life. Suppose primary care clinicians were to refer patients to clinical professionals who will educate patients about intuitive eating. In that case, there could be a drastic decrease in the number of metabolic disorder patients who present with dysfunctional eating habits after receiving treatment. With such a high prevalence of disordered eating behaviors in patients with metabolic disorder, increased research is needed to understand this complex and overlooked relationship between disordered eating and metabolic disorder with the ultimate goal of offering effective behavioral treatments for these conditions and to improve a patient’s quality of life.

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