

# **A study on the relationship between ADHD and binge eating disorder in unmedicated adults, as moderated by impulsivity and poor self-regulation.**

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*I hereby declare that the Research Report submitted for the BA Honours in Psychology degree to The Independent Institute of Education is my own work and has not previously been submitted to another University or Higher Education Institution for degree purposes.*

*Signed by Thalia Bimota Frost*

*on the 27 October 2020*

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## **Abstract:**

The present study aimed to investigate the possible comorbid relationship between binge-eating disorder and attention-deficit hyperactivity disorder through the moderating variables of impulse control and self-regulation. 55 participants diagnosed with ADHD responded to a self-report survey, from which it was noted that individuals with ADHD; struggle with controlling food-related impulses, are unable to self-regulate especially in times of heightened emotionality, and frequently present with symptoms in line with the diagnosis of binge-eating disorder.

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# Introduction

## Contextualisation

This study finds itself within the area of psychopathological research as it aims to investigate the relationship between two recognised disorders. Both attention-deficit and hyperactivity disorder (ADHD) and binge-eating disorder (BED) were recently updated in the fifth edition of the diagnostic and statistical manual of mental disorder. In this recent edition, binge-eating disorder was officially separated from falling within eating disorder not otherwise specified (EDNOS). Additionally, ADHD and its diagnostic criteria was updated to allow for the diagnosis of the disorder within adulthood. In previous editions, prior to the text revision published in 2000, ADHD was considered a childhood neurodevelopmental disorder which diminished as the patient developed into adulthood. The DSM-IV-TR did include the possibility for adult diagnosis but this was a novel idea and as such it was poorly understood – the updated diagnostic criteria published in the DSM-5 in 2013 has the advantage of an additional thirteen years of critical research. As BED and adult-ADHD are contemporary disorders, little is known about their comorbidity and their interaction. This study hypothesised that these disorders frequently coincide through shared deficits in executive functions. Executive function is a poorly operationalised concept which lacks a universally accepted definition – however, it essentially refers to a complex set of neurocognitive abilities which regulate a multitude of tasks such as goal-setting, inhibition, self-regulation, planning, and working memory (Baggetta & Alexander, 2016).

## Rationale

Westerberg & Waitz (2013) estimated that the lifetime prevalence of BED in women is 3,5% and 2% in men – this is significantly higher than the prevalence of both anorexia and bulimia nervosa. In comparison, the prevalence of ADHD in adulthood is estimated to be 2,8% (Fayyad et al., 2017). While ADHD has gained popularity in recent psychological research due to a steadily increasing prevalence in childhood, BED is under studied in comparison to other eating disorders despite its prevalence. This study chose these disorders as the main focus due to these rates of prevalence. Eating disorders have some of the highest mortality rates in comparison to other psychiatric disorders – the physical and mental impact of these disorders last throughout the lifetime even with treatment and recovery (Arcelus, Mitchell, &

Wales, 2011; as cited in Bleck, DeBate, & Oliviardia, 2014). With both of these disorders occurring so frequently, it is essential that empirical research be conducted on their possible interaction with one another. This empirical research has added to the growing body of knowledge on these disorders and provides a valuable foundation from which positive interventions can be developed.

### Problem Statement

Due to their novelty, adult-ADHD and BED are under studied and little is known about their interaction with one another – although the underlying similarities between the two have been noted in previous literature. It is imperative that this study bridge the gap found in the combined knowledge of these disorders by investigating how adults with diagnosed ADHD present habitual binge-eating episodes, and the relation that this may have with deficits in impulse control and self-regulation.

### Research Goal, Aim, and Purpose

The purpose of this study was to investigate the comorbid relationship between ADHD and binge-eating in unmedicated adults. This investigation focused on deficits of executive functioning, such as impulse control and self-regulation, in relation to eating and food habits. This study aimed to fill the gap in etiological knowledge, which will then form a basis for the development of effective intervention strategies.

There are three main objectives of the study. First, the study aimed to investigate the occurrence of binge-eating episodes within the sample. Second, the study ascertained whether these episodes are linked to poor impulse control. And thirdly, the study investigated whether these episodes are linked to poor self-regulation (including emotional regulation). The study has three hypotheses. Hypothesis 1 posits that participants experience difficulty with regards to their impulsivity, Hypothesis 2 states that participants frequently find themselves unable to regulate their behaviour during times of increased emotionality, and finally Hypothesis 3 states that participants exhibit symptoms related to binge-eating disorder.

### Research Question

Is there a comorbid relationship between binge-eating disorder and attention-deficit hyperactivity disorder characterised by deficits in impulse control and self-regulation?

# Literature Review

## Introduction

Attention-deficit hyperactivity disorder has historically been defined as a childhood developmental disorder, wherein the symptoms were said to diminish as the patient developed into adulthood. In recent years, critical studies have found that attention-deficit hyperactivity disorder (ADHD) indeed continues into adulthood. This research study hypothesises a relationship between ADHD and binge-eating disorder. Binge-eating disorder (BED) is characterised by repeated episodes in which the patient experiences a lack of control over their eating and eats an uncomfortable amount of food within a short period of time (Berkman et al., 2015). The present study theorises that the two disorders are linked by similarly impaired executive functions. To effectively study the relationship between attention-deficit hyperactivity disorder and binge eating disorder, past research on both disorders was critically reviewed in an effort to inform the current study. The synthesis of previous literature allowed the study to be holistically representative of past research. The following literature review consists of an outline and justification for the chosen area of research, discussion of the theoretical foundation, the conceptualisation of key concepts, and the integration of past literature on executive function, ADHD, and BED.

## Theoretical Foundation

The foundational theory for the present study is Executive Function. This is a multidimensional theory, which comprises of several behavioural and cognitive elements (Baggetta & Alexander, 2016). Executive function (EF) is a complicated concept that lacks a universal operational definition however, several definitions of executive functioning have been provided by researchers, and through meta-analysis of past research Baggetta and Alexander (2016) describe EF as, “a set of cognitive processes that: (1) guides action and behaviours essential to aspects of learning and everyday human performance tasks; (2) contributes to the monitoring or regulation of such tasks; and (3) pertains not only to the cognitive domain, but also socioemotional and behavioural domains of human performance” (p.24). Examples of these processes include: response inhibition, working memory, self-regulation, problem-solving, or cognitive fluency (Adler et al., 2016, Barkley et al., 2011;

Bayraktar, Özkorumak Karagüzel, & Tiryaki, 2019; Savci et al., 2019). Baggetta and Alexander (2016) describe various models<sup>1</sup> used to define and operationalise EF – their review of previous literature concluded that two models were referenced most often. The Diamond Model (2013) and the Miyake Model (2000), as cited in Beggatta and Alexander (2016), each categorise executive functions into three broad categories. Diamond (2013) includes inhibition, working memory, and cognitive flexibility, while Miyake et al. (2000) includes updating, set shifting, and inhibition. Additionally, Diamond (2013) posits that these three core functions operate in unison to build more complex functions such as reasoning, planning, and problem solving (Baggetta and Alexander, 2016).

Improvements in executive functions can result in better behavioural self-regulation – this is of particular importance when investigating the relationship between ADHD and BED. Inhibitory control as an executive function is most relevant to the proposed research task, although all three basic components interact to form a number of outcomes within executive functioning (Diamond, 2013; as cited in Beggatta & Alexander, 2016). Inhibition is defined as the intentional and controlled suppression of dominant, automatic and prepotent responses (Yates et al., 2013, as cited within Karyotaki, Drigas, & Skianis, 2017). When investigating executive functioning within ADHD patients, response inhibition and impulsivity have been empirically linked to the disorder (Karyotaki et al., 2017). Combined with poor emotional regulation (Van Stralen, 2016, as cited in Kayrotaki et al., 2017), inadequate response inhibition could be linked to frequent emotional eating which may account for the comorbidity of ADHD and BED.

### Conceptualisation & Operationalisation

Through the operationalisation and conceptualisation of key concepts, this study effectively measures the relationship between ADHD and BED. The categorisation of three subsections of executive functioning, namely cognitive flexibility, inhibitory control, and working memory (Baggetta & Alexander, 2016), allowed the research study to accurately measure the interactions between EF, ADHD, and BED through an informed self-report survey. As mentioned above, the two disorders are thought to be linked through the theory of executive function. As

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<sup>1</sup> See annexure A

ADHD is the independent variable within the proposed study, this disorder does not need to be operationalised further than official diagnosis by a qualified professional – within the survey this diagnosis is further categorised by age of diagnosis in order to account for the confounding variable that may occur due to early diagnosis. BED is conceptualised in congruence with the diagnostic criteria outlined in the fifth edition of the diagnostic and statistical manual (DSM-5), wherein the disorder is described through recurrent binge-eating episodes (American Psychiatric Association, 2013). These episodes are described as a discrete period of time wherein an amount of food that is disproportionate to the average amount is consumed. Marked distress is reported during these episodes, and they occur at least once a week for three months. Critically, these episodes are not coupled with inappropriate compensatory behaviours such as purging or fasting (Berkman et al., 2015). The conceptualisation of executive dysfunction is primarily focussed on the elements of inhibition control and self-regulation (Baggetta & Alexander, 2016). Through specific survey questions, the study assessed whether inhibition control is frequently compromised, resulting in binge-eating episodes wherein a lack of control is felt by the participant, and/or whether participants note that they struggle with self-regulation and the implementation of appropriate regulation strategies. A self-report survey has been developed which aims to investigate the above.

### ADHD & Executive Function

#### History and Distribution of ADHD

Attention-deficit and hyperactivity disorder (ADHD) was traditionally identified as a childhood neurodevelopmental disorder which would resolve as the patient developed into adulthood. Following research into the presentation of ADHD in adulthood, the DSM-5 updated the definition of ADHD to further include the diagnosis of adult-patients (American Psychiatric Association, 2013). Critically these changes did not fundamentally change the concept of the disorder, and instead were included to improve assessment of the disorder in adulthood. Longitudinal studies have found that ADHD continues from childhood to adulthood in two thirds of patients (Faraone, Biederman, Spencer, Mick, Murray, & Petty et al., 2006; as cited in Zalsman & Shilton, 2016). The presentation of ADHD symptoms are noted to markedly impair daily functionality, specifically in occupational and social contexts. The inattentive-type was found to be the most prevalent among adults and the

gender distribution far more balanced in adult-ADHD when compared to statistical prevalence in childhood (Zalsman & Shilton, 2016). Female patients are noted to internalise difficulties more so than male-counterparts, which may account for under-identification by guardians and educational professionals in childhood (Gershon, 2002; as cited in Zalsman & Shilton, 2016) and may explain a burst of “pseudo-new” cases of ADHD diagnosed in adulthood where self-referral is common. Treatment for ADHD in adulthood is the prescription of stimulant medications, such as methylphenidate, in combination with non-pharmacological treatment like cognitive behavioural therapy (Savci, Tufan, Öztürk, & Cansiz, 2019; Zalsman & Shilton, 2016).

#### Clinical Presentation/Structure of ADHD in Adulthood

The DSM-5 requires fewer symptoms for an adult diagnosis due to less overt presentation (Adler, Faraone, Spencer, Berglund, Alperin, & Kessler, 2017). It has been posited that adults have more diverse deficits in higher-level executive functioning and emotional control (Barkley, Murphy, & Fisher, 2008; as cited in Adler et al., 2017). Adult-ADHD is diverse, and the core symptoms of impulsivity, hyperactivity, and inattention are expressed subtly. Hyperactivity may present as an internalised restlessness, talkativeness, or excessive fidgeting. Impatience, incapability of maintaining personal relationships, and any attention seeking behaviour (including risk taking behaviour) are some of the ways in which impulsivity can present. And other complaints such as procrastination, disorganisation, and being easily distracted are an expression of inattentiveness (Koojj et al., 2010; as cited in Zalsman & Shilton, 2016). These three core symptoms often lead to the development of psychosocial impairments (Zalsman & Shilton, 2016). These psychosocial impairments have been shown to affect interactions in the workplace, (Barkley et al., 2008; as cited in Barkley & Fisher, 2011), result in severe interpersonal consequences with family, friends, and partners, and frequent risky behaviour for instance; reckless driving, crime and comorbid substance use disorders (Zalsman & Shilton, 2016). Additional comorbidities have been noted, such as mood, personality, and anxiety disorders, these contribute to clinical difficulties regarding diagnosis and treatment (Sobanski et al., 2007; as cited in Zalsman & Shilton, 2016). Adler et al. (2017) found within their study that “adult ADHD is characterised by a broader set of symptoms than in DSM-5” (p.7), the additional

symptoms they identified have a foundation in executive dysfunction. Their study recommends that symptoms of executive dysfunction and poor emotional regulation be considered for inclusion in the diagnostic criteria of future editions of the DSM (Adler et al., 2017). This is in line with this study's hypotheses.

#### ADHD and Executive Dysfunction

While executive dysfunction has not been officially included in the ADHD diagnostic criteria featured in the DSM-5, numerous studies have conducted research on its contribution to the disorder. As a seminal author on the topic of ADHD, Russel A. Barkley has published various studies wherein he has discussed the interaction between ADHD and executive function deficits. For the proposed research study, the relation to executive dysfunction will be narrowed to only the investigation of response inhibition, and self-regulation. Response inhibition is the ability to reject reflexive behaviours in a given situation (Savci, 2019), the Stroop Color and Word Test (SCWT) and similar iterations are commonly implemented to test response inhibition in ADHD participants (Barkley et al., 2011; Bayraktar et al., 2019; Savci et al., 2019). The use of SCWT in previous research has linked poor response inhibition to ADHD, which is unsurprising given that impulsivity is a well-recognised symptom of the disorder (Zalsman & Shilton, 2016). Self-regulation has been defined within a number of studies as the ability to respond in an appropriate manner to external stressors, this includes emotional regulation and cognitive flexibility (Zelazo et al., 2003; as cited in Baggetta and Alexander, 2016). While no specific test for self-regulation has been developed, BRIEF is the second most used battery applied in studies on EF. BRIEF assesses components of executive function through nine scales that provide three indices. One of which is the Emotional Regulation Index, thus BRIEF is used to assess self-regulation (Gioia, Isquith, Guy, & Kentucky, 2000; as cited in Baggetta and Alexander, 2016). Adler et al. (2016) found that emotional "dyscontrol" occurs commonly in adult ADHD. As emotional control is synonymous with emotional regulation it is reasonable to assume that patients with ADHD are likely to lack appropriate self-regulatory skills. Considering the relation between ADHD and executive dysfunction, in conjunction with similar deficits within binge-eating disorder, the present study hypothesises that these deficits form a definitive link between BED and ADHD, and a self-report survey has

been developed which has drawn from the above concepts used in previous research.

## BED & Executive Function

### History and Prevalence of BED

In recent years, studies have confirmed that Binge Eating Disorder (BED) is an eating disorder distinguishable from others such as Bulimia Nervosa. With the disorder's inclusion in the DSM-5, professionals can diagnose patients with BED if they fit the following criteria: patient shows an unusually large intake of food without compensatory behaviours, within a discrete time period, and a subjective experience of loss of control (LOC) (APA, 2013; Ballarotto, Porreca, Erriu, Ronconi, Cimino, Cerniglia, & Tambelli, 2017). Studies have shown that patients diagnosed with BED have higher levels of impulsivity (Manasse, Forman, Ruocco, Butryn, Juarascio, & Fitzpatrick, 2014) and difficulties in identifying their own emotions. Alexithymia conceptualises the inability to recognise, regulate, and describe one's emotional experience (Ballarotto et al., 2017). Ballarotto et al. (2017) found that alexithymia has an influence on BED behaviours, it can be assumed that this falls within the realm of executive dysfunction due to its relation to self-regulation. Granieri & Schimmenti (2014), as cited in Ballarotto et al. (2017), note that a consequence of emotional dysregulation is the development of disordered eating due to a reliance on food as an external source of regulation. Compared to control groups, patients with BED have high rates of comorbid psychiatric disorder and suffer impairment in various psychosocial contexts (Wilfley, Wilson, & Agras, 2003; as cited in Manasse et al., 2017). Treatment for patients with BED includes various behavioural therapies, and the prescription of stimulant medications, such as methylphenidate and lisdexamfetamine. The prescription of stimulant medication has proved to be useful as the side effects include loss of appetite and reduced impulsivity (Davis, Levitan, Kaplan, Carter-Major, & Kennedy, 2016).

In terms of global distribution and prevalence of the disorder, BED is believed to be more commonly diagnosed in female patients under the age of 38. It is estimated that more than 1% of the world population will be affected by eating disorders during their lifetime (Jacob, Haro, & Koyanagi, 2018). Eating disorders present significant public health concerns. While prevalence may be considered low, eating disorders have an incredibly high mortality rate - when compared to other

mental illness - and associated health consequences can progress to long term physical and mental health issues (Arcelus, Mitchell, & Wales, 2011; as cited in Bleck et al., 2014). Further understanding of the risk factors for disordered eating is essential for the development of targeted interventions to prevent or treat this condition, and to mitigate its impact on the population. Research focussed on the comorbid nature of ADHD and BED will hopefully lead to further investigation of appropriate interventions which can be universally applied to psychiatric patients.

#### BED and Executive Dysfunction

There has been a lack of reliable research on the relation between BED and executive function, as such the cognitive processes underlying BED are poorly understood. Due to this gap in literature, one must infer connections to executive dysfunction. Evidence suggests that the subjective feeling of loss of control is a prominent marker of eating disorder psychopathology (Goldschmidt, Hipwell, Stepp, McTigue, & Keenan, 2008; as cited in Kittel, Schmidt, & Hilbert, 2017). While studies on the impact of EF deficits on BED are sparse, Kittel et al. (2017) posits that the sense of loss of control implies that self-regulatory difficulties play an important role in the development of BED. As self-regulation is frequently understood as a neurological process within executive functioning, BED has an assumed connection to this aspect of EF. As mentioned previously, self-regulation is essential for emotional regulation. Emotional regulation (ER) includes the understanding and recognition of emotions, inhibition of inappropriate emotional response, and access to situationally appropriate ER strategies (Kenny, Singleton, & Carter, 2017). In patients with BED who experience alexithymia and have difficulties regulating emotion, binge-eating is frequently applied as an external solution to intense emotionality. This leads to an increased reliance on binge-eating as an ER strategy (Kenny et al., 2017).

Furthermore, within the meta-analysis conducted by Giel, Teufel, Junne, Zipfel, & Schlag (2017) it was found that individuals with BED show increased general impulsivity when compared with control groups. BED patients show rash-spontaneous behaviour toward food and under general conditions where inhibitory control is required. Both Manasse et al. (2017) and Kittel et al. (2017) focussed studies on the possibility of executive functioning deficits reinforcing BED. Their studies both tested executive functions with a battery of tests, including the SCWT

aimed at testing impulsivity and inhibition in participants. Manasse et al. (2017) found that binge eating is “characterised by a reduced ability to efficiently recruit inhibition processes” (p.682). These findings further link BED and executive function deficits related to inhibition. However, a significant limitation involved in both the Manasse et al. (2017) and Kittel et al. (2017) studies was the exclusion of participants who were not obese. Both studies used body mass index (BMI) as a measurement of obesity and related all their research on BED with obesity. BMI has been proved to be a poor indication of body fat and has numerous inaccuracies (Nuttal, 2015; Batsis, Mackenzie, Sahakyan, Somers, & Lopez-Jimenez, 2016). Nuttal (2015) concludes their study on the value of the BMI by noting that “it is time to move beyond the BMI as a surrogate for determining body fat mass” (p.124). Furthermore, it is pertinent to note that obesity is not a prerequisite for the diagnosis of BED. Patients with BED can differ in many regards, from age to weight – therefore Kittel et al. (2017) and Manasse et al. (2017) excluded a significant portion of BED patients resulting in findings that may not be generalisable to the entire target population. As weight is not directly linked to the disorder, the inclusion of a ‘weight’ criteria in the present study has been disregarded.

## ADHD & BED

### Impulsivity

As noted previously, Baggetta & Alexander (2016) found that impulse control or response inhibition is the most frequently referenced component of executive function. Impulse control is defined as the ability to deliberately control or inhibit automatic behaviours, responses, or thoughts (Baggetta & Alexander, 2016). The diagnostic criteria for attention-deficit hyperactivity disorder includes, but is not limited to, the presence of impulsivity (APA, 2013). Both Adler et al. (2017) and Zalsman & Shilton (2016) posit that impulsivity in adult ADHD does not present externally and most often manifests as internalised restlessness. Despite this feature of internalisation, impulsivity is formally recognised as a core symptom of ADHD. Previous research has also drawn a parallel between binge-eating disorder and impulsivity. Ballarotto et al. (2017), Giel et al. (2017), Blume et al. (2019), Manasse et al. (2015), and Kenny et al. (2017), have inferred from their research that increased impulsivity is likely an factor in the development of BED. Impulsivity has been divided into two subsections; (1) a motivational dimension, typically tied to

emotional regulation, and (2) a behavioural dimension, related to inhibition (Giel et al., 2017). Notably, chosen studies on the relation between ADHD and eating disorders have all aimed to measure impulsivity as an underlying factor for the interaction. Cortese, Bernardina, & Mouren (2007), while dated and based on the fourth edition of the DSM (DSM-IV), focussed solely on BED resulting from ADHD in contrast to other similar studies which focussed on eating disorders in general. It was hypothesised through critical review of research that impulsivity, deficient inhibitory control, and delay aversion may contribute to the development of abnormal eating behaviours (Cortese et al., 2007). Through correlational studies conducted on patients with eating disorders, it has been found that patients with hyperactive/impulsive-type ADHD are more likely than inattentive-type patients to exhibit behaviours associated with bingeing and purging (Svedlund, Norring, Ginsberg, & van Hausswolff-Juhlin, 2017; Jacob et al., 2018; Bleck et al., 2014). In fact, Jacob et al. (2018) recommends that all individuals with ADHD be regularly screened for symptoms of disordered eating. However, the interaction of impulsivity between bingeing behaviours and ADHD is disputed by Stulz, Hepp, Gachter, Martin-Soelch, Spindler, & Milos (2013). Their correlational study found that impulsivity was not a predictor of eating-related impulse behaviour – such as binge-eating. It should be noted that the Stulz et al. (2013) study has various limitations such as small sample size, ADHD self-report questionnaires used in data collection (as opposed to formal assessment), and the use of DSM-IV text revision (DSM-IV-TR) diagnostic criteria wherein the diagnosis of ADHD in adulthood was novel. At least some level of association between impulsivity, ADHD and disordered eating has been previously assessed. However, the present study aims to narrowly investigate impulsivity in relation to BED and ADHD. It is through this specificity that the study will bridge the gap in knowledge relating to the comorbidity of these disorders and facilitate future formulation of psychological interventions.

#### Self-Regulation

Baggetta & Alexander (2016) found self-regulation, a neurocognitive process facilitated by executive function, conceptualised in numerous studies on executive function. In fact, Zelazo et al. (2003), as cited in Baggetta & Alexander (2016) devised a model of executive functions in which regulatory behaviours are divided into “cool” and “hot” categories. “Cool” executive functions involved cognitive control

such as planning and goal setting, while “hot” executive functions describe emotional regulatory skills and strategies (Zelazo et al., 2003; as cited in Baggetta & Alexander, 2016). Difficulties in self-regulatory strategies has been noted previously in studies relating to binge-eating disorder. For example, Ballarotto et al. (2017) noted that alexithymia could disrupt emotional regulation, thus resulting in the development of unhealthy regulatory strategies such as binge-eating. Furthermore, Kenny et al. (2017) reported that individuals with BED noted greater difficulties with regard to emotional regulation, and “difficulties in ER were positively associated with binge frequency” (p.1303). Adler et al. (2017) studied the structure of ADHD in adult patients and found that emotional dyscontrol (which has been previously linked within this literature review to emotional regulatory deficits) was a distinct component of the disorder which had been overlooked in the DSM-5 diagnostic criteria. It was recommended that clinicians “consider including these additional symptoms in their evaluations of patients for adult ADHD” (p.10). Additionally, Brown (2005); as cited in Savci et al. (2019), suggests that executive function deficits in ADHD include emotional regulation. Savci et al. (2019) also mentions that patients diagnosed with ADHD frequently report persistent difficulties managing emotions and were prone to experiencing intense emotions. Loss of control is frequently referenced as a central issue in both ADHD and BED (Svedlund et al., 2017). LOC is associated with alexithymia, as mentioned previously, and may result in inefficient regulatory strategies such as binge eating. Davis, Levitan, & Smith (2006); as cited in Svedlund et al. (2017), found an association between ADHD symptoms, binge eating, and emotionally induced eating within participants from a community sample. There is a general lack of literature linking ADHD and BED with regard to deficits in self-regulatory executive functioning – this study aimed to identify self-regulation as a commonality between these two disorders.

### Conclusion

Through the critical review of past literature on binge-eating disorder and attention-deficit hyperactivity disorder, the present study aims to narrowly investigate the underlying relation between the two disorders in terms of executive functioning deficits. The most commonly referenced deficits between both ADHD and BED are related to impulsivity and self-regulation, therefore the study only focused on measuring these. Whilst similar symptoms appear to underly both BED and ADHD,

there is an evident lack in literature wherein BED has been the specific focus. Past literature has instead focussed on eating disorders in general. In order to narrowly investigate the hypothesis that these disorders are highly comorbid, the present study aims to assess binge-eating behaviours, impulsivity, and self-regulation through a self-report survey conducted among adult participants who have been formally diagnosed with ADHD and who are not currently on medication. The addition of a non-medicated prerequisite hoped to avoid the intervening variable caused by stimulant medications<sup>2</sup>.

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<sup>2</sup> Stimulant medications, as mentioned above, are frequently prescribed to patients with ADHD or BED.

# Methodology

## Research Paradigm

The present study takes place within a positivist paradigm, focussing on quantitative data collection and analysis. The positivist paradigm has specific interest on interpreting observable data to understand a concept without subjective opinion. Data is considered objective and can be quantified and interpreted statistically. In order to investigate the hypothesised link between ADHD and BED, the study aimed to collect quantitative data which was statistically analysed to accept or deny the hypotheses. While there is merit in subjective data, the experience of patients with ADHD or BED is well studied, and the interaction between these two disorders should be objectively observed to possibly link the two, thereby allowing for further research into appropriate interventions. Axiologically the study should focus on providing a conclusion independent of researcher bias or opinion and found knowledge should be viewed from an external standpoint. Reality within this paradigm is seen as constant, observable, and independent of individual experience. The present study seeks to link two disorders independently of subjective experience to provide evidence of their comorbidity.

## Research Design

The positivist research tradition can be broadly described as the approach of the natural sciences. Positivists believe in the application of empirical methods to study phenomena. With a basis in the era of Enlightenment, positivism insists that only objective, observable, and verifiable facts should be considered when attempting to explain natural and social phenomena. While interpretivism has established itself as a valuable and useful tradition, the present study is focused primarily on the comorbid relationship between ADHD and BED – as such the subjective experience of individual participants is not considered relevant in the discovery of this relationship. Following in the epistemological position of positivism, the study is only interested in objective and observable (empirical) evidence. Positivists believe that knowledge is the result of empirical observation only – while this is not necessarily the case with all knowledge, the research study recognises the value of empirical observation when considering the comorbidity of two psychopathological disorders. Knowledge was therefore obtained through observation and the testing of assumptions against objective reality. Ontologically,

positivists hold the view that there is a single, observable, and external reality that is governed by universal laws. It is through these laws that reality can be observed and measured. Through this objective reality, cause and effect can be universally generalised to the population, without the need for examining the internal motivations of the individual. The study aims to generalise the comorbid relationship between ADHD and BED to the target population as much as feasibly possible – considering the reliability and validity of the methods and results.

As positivists are concerned with objective, empirical data in the investigation of causal relationships it is noted that the methodological position of positivism is centred upon quantitative research. Since the aim of positivist research is to find reliable causal relationships, positivists favour recording facts in terms of quantities that can be further analysed using statistical techniques. Nomothetic, or quantitative, methodology is characterised by procedures aimed at the discovery of general laws (Maree, 2020). This study will therefore employ quantitative methods to investigate the relationship between the two disorders. Through these quantitative methods data was then analysed statistically in order to investigate the hypotheses.

Within quantitative methods there are two forms of research design: experimental and non-experimental. The present study falls within a non-experimental research design. These designs do not entail the manipulation of variables – instead it is focussed on observing the relationship between variables. Non-manipulation or non-experimental designs are used within nomothetic research studies where experimental designs are not necessary or are difficult to implement. In the study, the research aims to understand the strength of the real-life relationship between three variables. The independent variable has been noted as ADHD, the dependent variable is BED, and finally the perceived moderator variable has been theorised to be deficits in the executive functions of impulse control and self-regulation. The study aims to form an explanatory model of the relationship prior to the experimental testing of positive psychological interventions. It is also pertinent to note that the variables cannot be manipulated in a study of this nature, and therefore an experimental design would not be feasible.

As this non-experimental design is aimed at the understanding of the relationship between these variables, it is considered unnecessary for the study to

take place longitudinally. A cross-sectional design was applied where data could be collected at a single point in time, rather than over a designated period. Data was collected only once, and the study instrument to be used was a self-report survey. The survey aims to gather data which can then be analysed statistically in order to evaluate the hypotheses. The research methodology, such as sampling and data analysis, will be the focus of the next section.

## Research Plan & Methodology

### Population & Sampling

The results of this research study aims to improve the understanding of ADHD and its comorbidity with BED. As such, the target population has been identified to be all adults above the age of 18, who have been formally diagnosed with ADHD by a medical professional. From this, the units of analysis for the proposed study is people, and not other units. Unfortunately, this target population is much too large for effective random sampling (which would typically be the sampling method of choice for a quantitative study), in order to access the target population as much as possible this study has employed convenience sampling. The use of convenience sampling narrows the target population into an accessible population. This accessible population is limited to individuals who are over the age of 18, have been formally diagnosed with ADHD, have access to the internet, and are active community members on popular forums on chosen social media platforms.

From this accessible population a sample was chosen who fell within specific sampling criteria. The participants were limited to persons who were;

- Between the age of 18 and 55
- Native/Fluent English speakers
- Formally diagnosed with ADHD at various developmental stages
  - o 0 – 7 years old
  - o 7 – 12 years old
  - o 12 – 18 years old
  - o 18+ years old
- Currently unmedicated for ADHD (including herbal remedies and licensed pharmaceuticals)
- Unmedicated for at least three months prior to participation

As the study was to be conducted in English, the sample was limited to those who were fluent in the language so that they would be able to fully understand what they were consenting to and would be able to answer the research questions effectively. Additionally, to avoid the possible confounding influence of methylphenidate (and other stimulants used in the treatment of ADHD) all participants were to be unmedicated for their ADHD for at least three months prior to their participation. The added demographic criteria of the age of diagnosis was included to further prevent confounding variables, it was theorised that the results of the study may be influenced by whether the participant was diagnosed at a young age and had therefore learnt behaviours which may curb the development of symptoms of either disorder. It was later found that age of diagnosis had a statistically insignificant influence on the results

While the initial research proposal had aimed for a minimum of 150 participants, this aim was not met. Instead, data was collected from 206 participants, of which only 55 met the sampling criteria. Additional responses have been stored for future research purposes, but data analysis has focussed on these 55 participants who meet requirements.

Participants were sourced using convenience sampling. Convenience sampling is defined as a non-probability sampling method wherein participants are chosen due to their ease of access, while efficient this sampling method does not result in a representative sample (Maree, 2020). Due to the size of the target population, this sampling method was chosen in order to easily access the population for the study. This method is a significant limitation in this study however, it does allow for an approximation of the truth upon which further research can be based. A convenient sample of the target population was accessed via online forums based within two popular social media platforms, Reddit and Facebook. These social media platforms were chosen due to the ability to access forums which were dedicated to ADHD, mental health, and academic studies – which would facilitate access to the population.

#### Methods of Data Collection

As the proposed study is concerned with the collection of empirical data, the chosen method for data collection was identified as an online survey. This survey

allowed for the collection of cross-sectional data where participants were only asked for their participation once and where follow-up information was not prioritised.

The proposed survey<sup>3</sup> was distributed to the accessible population. The survey consisted of a variety of items with varying forms. All items were closed-ended questions with a set choice of options from which the participant could choose the answer which was most appropriate for them, this prevented the study from collecting subjective data.

Demographical information, such as gender, age, medication, and diagnosis, were gathered – this section enabled the study to ascertain which participants successfully fulfilled the sampling criteria. The demographical information was collected first and included additional questions such as whether the participant had also been diagnosed with an eating disorder. Section 2 of the survey consisted of items which were aimed to measure impulsive control within the sample. Questions began by assessing general impulse control and concluded by assessing how impulse control contributed to the participants' eating habits. The third section aimed to assess the participants' ability to self-regulate – these questions measured emotional regulation as well as the participants' ability to regulate themselves. Finally, a section was included that assessed the participants' general feelings towards their eating habits.

It must be noted that the final question of the survey, which aimed to assess how participants would describe their relationship with food, was not included in final analysis. The responses to this question were too subjective and resulted in data which was not helpful – if time had been permitted the study would have initially conducted a pre-test which may have facilitated the review and removal of unhelpful items. In addition to the removal of this item, it was deemed unnecessary for the study to consider which eating disorders relevant participants had been diagnosed with – therefore this question was also removed from analysis. Each item answer was assigned a corresponding numerical value, which allowed for statistical analysis of the data.

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<sup>3</sup> See annexure B

Data was only collected from the accessible population once due to the cross-sectional nature of the study. The survey was posted on relevant forums in order to sufficiently access the population. It was deemed unnecessary to narrow the population in terms of geographical location, as focus on a specific country or region would jeopardise further generalisability of the data. Due to this, Reddit and Facebook were chosen as the platforms on which to administer the survey due to their popularity, access to the population, and their globalised nature. The personal account of the primary researcher was used to access these forums and create the post from which the population could access the survey.

#### Application of Data Collection

Included in Addendum A is a copy of the survey that was given to the population. The survey was initially created in a Word document, and from here the online application *Google Forms* was used to create the survey. *Google Forms* was chosen due to its ability to collect data effectively. *Google Forms* allows the user to create unique surveys, which include required answers, for which a unique link is created to allow participants to access the survey. Participants were provided with a detailed information sheet and consent form before they were permitted to continue with the study. As participation in a psychological study is not without risks, it was important that each participant read and understood the information sheet, and that each participant consented to their participation in the study. Participation was voluntary, if a participant was unwilling to proceed, they could exit the online survey at any point. Each participant was required to answer that they had read the information sheet and consented to participation. From here the participants could answer items that had been separated according to the four sections mentioned previously.

Forums were chosen on Reddit and Facebook due to their ability to access the population. For example; the subreddit<sup>4</sup> *SampleSize*<sup>5</sup> was chosen due to its nature as a forum for which individuals can post academic and personal surveys. Additional forums included those which were specifically for the discussion of mental and physical health. A generic post was formulated to attract participants<sup>6</sup>. As a

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<sup>4</sup> Technical term for an online forum based on Reddit

<sup>5</sup> See annexure D

<sup>6</sup> See annexure C

function of Google Forms all responses were automatically recorded and analysed basically. However, this data included information from individuals who were not within the sampling parameters. The data collected was exported to an Excel document wherein it was filtered to only show responses from participants within the sampling criteria. Additional information that was collected was stored for future reference. Once data was placed in an Excel spreadsheet, a unique ID was given to each participants response. The nominal responses were then converted into numerical values which were previously decided upon<sup>7</sup>. The conversion of text to numerical values was necessary in order to statistically analyse the data in the next stage.

#### Methods of Data Analyses

Once the relevant data was collected and filtered from other responses, the data was processed using statistical analysis. The proposed method of analysis was originally IBM's SPSS software. Unfortunately, the primary researcher was not able to gain sufficient access to this software or to its open source counterpart PSPP. Due to this, analysis was conducted using JASP open source statistical software, this software was developed and funded by the University of Amsterdam.

As outlined in the research proposal, the initial analysis was descriptive in nature. Descriptive statistics aims to arrange and summarise raw data into meaningful information which can then be displayed. Descriptive analysis aimed to investigate: gender and age distribution, which subtype of ADHD was most common within the sample, at which age majority of the sample had been diagnosed with ADHD, and what percentage of the sample had also been diagnosed with an eating disorder. Awareness of the distribution of each of these characteristics improved the generalisability of the data by allowing the researcher to identify representative characteristics of the sample that are in line with the target population. In addition to frequency and distributive statistics, descriptive analysis included the calculation of mean, standard deviation, skewness, kurtosis, and the minimum/maximum values for each item. The application of these statistical functions organised and summarised the data in order to promote an understanding of the data characteristics (Maree, 2020). In addition to these descriptive statistics, the data was additionally analysed using Pearson's correlational coefficient ( $r$ ) which aided the

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<sup>7</sup> See annexure E

researcher in analysing how each question within the survey correlated with the others. These methods of analysis aided the research in the investigation of the hypotheses and improved the overall understanding of the relationship between ADHD and BED.

#### Application of Data Analysis Methods

From Google Forms the results were exported to an Excel document for analysis. Within this the data set was narrowed to applicable responses from participants who fulfilled the sampling criteria, and as mentioned previously these responses were then converted into representative numerical values using an if-function in Excel. The use of the if-function reduced the possibility of human error when inputting the data. A separate sheet was created that included only relevant responses, and these responses were filtered according to demographic information such as gender and age. This data set was then converted to a file format compatible with JASP (.osds), and then exported to the JASP software.

Using JASP software, the data was then analysed descriptively. Descriptive statistics are automatically calculated within the software, and the results were then displayed using tables. To begin, descriptive statistics were calculated for the demographic section of the survey. This allowed the research to ascertain aspects of the sample which were more common, such as gender and participant age, and the research could investigate which subtype of ADHD was most frequently recorded. Furthermore, descriptive statistics were then calculated for each following section of the survey. These descriptive statistics allowed the researcher to identify trends in the data. The results of the descriptive analysis were exported to a .html format, which was then reviewed using Microsoft Edge. A copy of this analysis was also stored remotely, this was done to ensure that the data could be accessed regardless of technological difficulties which may occur in the future.

The calculation of correlational statistics was facilitated by an independent data analyst, Monique Marshall, who processed the data using Python and provided the data to the researcher who then analysed and inferred results from this. Correlational statistics were exported to Excel for ease of analysis, and a copy was stored remotely for safekeeping. An easy to read table of the correlational findings is

included below in the presentation of the findings, each correlation is highlighted from light to dark green depending on their level of significance.

### Reliability & Validity

To ensure that the quantitative measures used in the present study were both reliable and valid, several popular reliability and validity methods were implemented.

Internal reliability was measured using Cronbach's Alpha. Cronbach's Alpha was calculated without the inclusion of demographic questions and was calculated to be 0.85 – this is an acceptable value and has shown the self-report survey to be internally reliable.

Validity was measured through face validity and content validity. Face validity while basic in its measurement of validity, is extremely useful. The researcher measured the validity of the instrument by assessing whether the instrument *appeared* to assess the constructs effectively. Content validity was ensured through the review of previous literature and the alignment of the measurement instrument to past valid and reliable instruments.

## Findings and Interpretation of Findings

### Statistical Findings

#### Demographic descriptive findings

| AGE DESCRIPTIVE    |             | SUBTYPE            |          | AOD                |          | GENDER             |          |
|--------------------|-------------|--------------------|----------|--------------------|----------|--------------------|----------|
| Mean               | 28,49090909 | Mean               | 2,4      | Mean               | 3,327273 | Mean               | 1,890909 |
| Standard Error     | 0,840022738 | Standard Error     | 0,159122 | Standard Error     | 0,139876 | Standard Error     | 0,056095 |
| Median             | 28          | Median             | 3        | Median             | 4        | Median             | 2        |
| Mode               | 24          | Mode               | 1        | Mode               | 4        | Mode               | 2        |
| Standard Deviation | 6,229775358 | Standard Deviation | 1,180082 | Standard Deviation | 1,03735  | Standard Deviation | 0,41601  |
| Sample Variance    | 38,81010101 | Sample Variance    | 1,392593 | Sample Variance    | 1,076094 | Sample Variance    | 0,173064 |
| Kurtosis           | 0,214676316 | Kurtosis           | -1,53057 | Kurtosis           | 0,023977 | Kurtosis           | 2,403756 |
| Skewness           | 0,455441843 | Skewness           | 0,002807 | Skewness           | -1,22196 | Skewness           | -0,76609 |
| Range              | 29          | Range              | 3        | Range              | 3        | Range              | 2        |
| Minimum            | 18          | Minimum            | 1        | Minimum            | 1        | Minimum            | 1        |
| Maximum            | 47          | Maximum            | 4        | Maximum            | 4        | Maximum            | 3        |
| Sum                | 1567        | Sum                | 132      | Sum                | 183      | Sum                | 104      |
| Count              | 55          | Count              | 55       | Count              | 55       | Count              | 55       |

The above four tables show the basic descriptive statistics of calculated for the data collected from the first section of the self-report survey, demographics. Results of interest were highlighted in green.

### Impulsivity descriptive findings

| <i>How often are you unable to resist impulsive behaviours or reactions?</i> |         | <i>How often do you order in take away or eat fast food?</i> |          | <i>Do you feel you experience a sense of loss of control over your eating?</i> |          | <i>Do you find that you eat more food or snack excessively when you are bored?</i> |          | <i>TOTAL IMPULSE</i> |          |
|------------------------------------------------------------------------------|---------|--------------------------------------------------------------|----------|--------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------|----------|----------------------|----------|
| Mean                                                                         | 2       | Mean                                                         | 4,054545 | Mean                                                                           | 3,145455 | Mean                                                                               | 2,745455 | Mean                 | 9,945455 |
| Standard Error                                                               | 0       | Standard Error                                               | 0,130831 | Standard Error                                                                 | 0,091446 | Standard Error                                                                     | 0,06471  | Standard Error       | 0,164978 |
| Median                                                                       | 2       | Median                                                       | 4        | Median                                                                         | 3        | Median                                                                             | 3        | Median               | 10       |
| Mode                                                                         | 2       | Mode                                                         | 4        | Mode                                                                           | 3        | Mode                                                                               | 3        | Mode                 | 11       |
| Standard Deviation                                                           | 0       | Standard Deviation                                           | 0,970265 | Standard Deviation                                                             | 0,678183 | Standard Deviation                                                                 | 0,479899 | Standard Deviation   | 1,223507 |
| Sample Variance                                                              | 0       | Sample Variance                                              | 0,941414 | Sample Variance                                                                | 0,459933 | Sample Variance                                                                    | 0,230303 | Sample Variance      | 1,49697  |
| Kurtosis                                                                     | #DIV/0! | Kurtosis                                                     | 0,758662 | Kurtosis                                                                       | 3,776424 | Kurtosis                                                                           | 1,962256 | Kurtosis             | -0,8169  |
| Skewness                                                                     | #DIV/0! | Skewness                                                     | -0,99572 | Skewness                                                                       | -1,29424 | Skewness                                                                           | -1,66853 | Skewness             | -0,20736 |
| Range                                                                        | 0       | Range                                                        | 4        | Range                                                                          | 3        | Range                                                                              | 2        | Range                | 5        |
| Minimum                                                                      | 2       | Minimum                                                      | 1        | Minimum                                                                        | 1        | Minimum                                                                            | 1        | Minimum              | 7        |
| Maximum                                                                      | 2       | Maximum                                                      | 5        | Maximum                                                                        | 4        | Maximum                                                                            | 3        | Maximum              | 12       |
| Sum                                                                          | 110     | Sum                                                          | 223      | Sum                                                                            | 173      | Sum                                                                                | 151      | Sum                  | 547      |
| Count                                                                        | 55      | Count                                                        | 55       | Count                                                                          | 55       | Count                                                                              | 55       | Count                | 55       |

The above five tables show the basic descriptive statistics of calculated for the data collected from the second section of the self-report survey, impulsivity. Results of interest were highlighted in green and results that may have affected these calculations were highlighted in red.

### Self-regulation descriptive findings

The below seven tables show the basic descriptive statistics of calculated for the data collected from the third section of the self-report survey, self-regulation. Results of interest were highlighted in green.

| <i>Do you struggle to regulate yourself in general?</i> |              | <i>Do you find yourself ordering in food so that you do not have to tidy up or spend time cooking?</i> |          | <i>How often do you eat food as a way to procrastinate doing tasks?</i> |          | <i>How often do you find yourself eating food as a distraction from intense emotions?</i> |          |
|---------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------|----------|
| Mean                                                    | 2,672727273  | Mean                                                                                                   | 2,145455 | Mean                                                                    | 3,981818 | Mean                                                                                      | 3,054545 |
| Standard Error                                          | 0,063852447  | Standard Error                                                                                         | 0,079638 | Standard Error                                                          | 0,249567 | Standard Error                                                                            | 0,186078 |
| Median                                                  | 3            | Median                                                                                                 | 2        | Median                                                                  | 5        | Median                                                                                    | 3        |
| Mode                                                    | 3            | Mode                                                                                                   | 2        | Mode                                                                    | 6        | Mode                                                                                      | 3        |
| Standard Deviation                                      | 0,473542421  | Standard Deviation                                                                                     | 0,590611 | Standard Deviation                                                      | 1,850835 | Standard Deviation                                                                        | 1,379992 |
| Sample Variance                                         | 0,224242424  | Sample Variance                                                                                        | 0,348822 | Sample Variance                                                         | 3,425589 | Sample Variance                                                                           | 1,904377 |
| Kurtosis                                                | -1,482171577 | Kurtosis                                                                                               | -0,14484 | Kurtosis                                                                | -1,19777 | Kurtosis                                                                                  | -0,99717 |
| Skewness                                                | -0,757040025 | Skewness                                                                                               | -0,03626 | Skewness                                                                | -0,49985 | Skewness                                                                                  | -0,14506 |
| Range                                                   | 1            | Range                                                                                                  | 2        | Range                                                                   | 5        | Range                                                                                     | 4        |
| Minimum                                                 | 2            | Minimum                                                                                                | 1        | Minimum                                                                 | 1        | Minimum                                                                                   | 1        |
| Maximum                                                 | 3            | Maximum                                                                                                | 3        | Maximum                                                                 | 6        | Maximum                                                                                   | 5        |
| Sum                                                     | 147          | Sum                                                                                                    | 118      | Sum                                                                     | 219      | Sum                                                                                       | 168      |
| Count                                                   | 55           | Count                                                                                                  | 55       | Count                                                                   | 55       | Count                                                                                     | 55       |

| <i>Do you eat excessively when you are experiencing particularly strong negative emotions?</i> |          | <i>How frequently do you find that you have not eaten for most of the day and find yourself eating a large meal to compensate?</i> |          | TOTAL REGULATION   |          |
|------------------------------------------------------------------------------------------------|----------|------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------|----------|
| Mean                                                                                           | 2,272727 | Mean                                                                                                                               | 2,418182 | Mean               | 16,54545 |
| Standard Error                                                                                 | 0,09158  | Standard Error                                                                                                                     | 0,120858 | Standard Error     | 0,502397 |
| Median                                                                                         | 2        | Median                                                                                                                             | 2        | Median             | 17       |
| Mode                                                                                           | 2        | Mode                                                                                                                               | 2        | Mode               | 20       |
| Standard Deviation                                                                             | 0,679176 | Standard Deviation                                                                                                                 | 0,896307 | Standard Deviation | 3,725876 |
| Sample Variance                                                                                | 0,461279 | Sample Variance                                                                                                                    | 0,803367 | Sample Variance    | 13,88215 |
| Kurtosis                                                                                       | -0,7751  | Kurtosis                                                                                                                           | -0,64614 | Kurtosis           | -0,44296 |
| Skewness                                                                                       | -0,39846 | Skewness                                                                                                                           | 0,174899 | Skewness           | -0,40558 |
| Range                                                                                          | 2        | Range                                                                                                                              | 3        | Range              | 16       |
| Minimum                                                                                        | 1        | Minimum                                                                                                                            | 1        | Minimum            | 7        |
| Maximum                                                                                        | 3        | Maximum                                                                                                                            | 4        | Maximum            | 23       |
| Sum                                                                                            | 125      | Sum                                                                                                                                | 133      | Sum                | 910      |
| Count                                                                                          | 55       | Count                                                                                                                              | 55       | Count              | 55       |

### General descriptive findings

The below three tables show the basic descriptive statistics of calculated for the data collected from the fifth section of the self-report survey, general ratings of food habits. Results of interest were highlighted in green.

| <i>How often do you feel uncomfortably full after you finish a meal?</i> |              | <i>How ashamed are you likely to feel after eating a large amount of food?</i> |          | <i>TOTAL GENERAL</i> |          |
|--------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------|----------|----------------------|----------|
| Mean                                                                     | 4,963636364  | Mean                                                                           | 5,581818 | Mean                 | 10,54545 |
| Standard Error                                                           | 0,190628301  | Standard Error                                                                 | 0,22427  | Standard Error       | 0,316566 |
| Median                                                                   | 5            | Median                                                                         | 6        | Median               | 11       |
| Mode                                                                     | 5            | Mode                                                                           | 7        | Mode                 | 11       |
| Standard Deviation                                                       | 1,413737316  | Standard Deviation                                                             | 1,663229 | Standard Deviation   | 2,347719 |
| Sample Variance                                                          | 1,998653199  | Sample Variance                                                                | 2,76633  | Sample Variance      | 5,511785 |
| Kurtosis                                                                 | -0,379215848 | Kurtosis                                                                       | 1,194521 | Kurtosis             | 1,814114 |
| Skewness                                                                 | -0,545617567 | Skewness                                                                       | -1,30135 | Skewness             | -1,2801  |
| Range                                                                    | 5            | Range                                                                          | 6        | Range                | 10       |
| Minimum                                                                  | 2            | Minimum                                                                        | 1        | Minimum              | 4        |
| Maximum                                                                  | 7            | Maximum                                                                        | 7        | Maximum              | 14       |
| Sum                                                                      | 273          | Sum                                                                            | 307      | Sum                  | 580      |
| Count                                                                    | 55           | Count                                                                          | 55       | Count                | 55       |

### Total Scores descriptive findings

The table below shows the basic descriptive statistics calculated for the total score of the survey from the sample as a whole. Results of interest were highlighted in green.

| <i>GRAND TOTAL</i> |          |
|--------------------|----------|
| Mean               | 37,03636 |
| Standard Error     | 0,804434 |
| Median             | 37       |
| Mode               | 36       |
| Standard Deviation | 5,96584  |
| Sample Variance    | 35,59125 |
| Kurtosis           | 0,775663 |
| Skewness           | -0,73832 |
| Range              | 29       |
| Minimum            | 19       |
| Maximum            | 48       |
| Sum                | 2037     |
| Count              | 55       |

### Correlational findings

|   | A     | B     | C     | D        | E      | F        | G     | H          | I     | J     | K     | L     | M     | N    |
|---|-------|-------|-------|----------|--------|----------|-------|------------|-------|-------|-------|-------|-------|------|
| A | 1,00  | 0,29  | 0,10  | -0,07    | -0,06  | 0,12     | 0,15  | 0,13       | 0,12  | 0,08  | -0,14 | -0,13 | 0,15  | 0,09 |
| B | 0,29  | 1,00  | -0,04 | 0,22     | 0,21   | 0,00     | 0,10  | 0,31       | 0,30  | 0,24  | -0,13 | -0,02 | 0,37  | 0,32 |
| C | 0,10  | -0,04 | 1,00  | -0,10    | -0,05  | 0,04     | 0,34  | 0,00       | 0,05  | 0,09  | -0,11 | 0,14  | 0,01  | 0,23 |
| D | -0,07 | 0,22  | -0,10 | 1,00     | 0,06   | 0,04     | 0,27  | 0,30       | 0,41  | 0,31  | 0,14  | 0,28  | 0,22  | 0,50 |
| E | -0,06 | 0,21  | -0,05 | 0,06     | 1,00   | 0,12     | 0,07  | 0,20       | 0,36  | 0,33  | 0,12  | 0,34  | 0,28  | 0,46 |
| F | 0,12  | 0,00  | 0,04  | 0,04     | 0,12   | 1,00     | 0,17  | 0,12       | -0,03 | 0,17  | 0,28  | 0,23  | 0,27  | 0,34 |
| G | 0,15  | 0,10  | 0,34  | 0,27     | 0,07   | 0,17     | 1,00  | 0,09       | 0,17  | 0,22  | 0,13  | 0,10  | -0,01 | 0,33 |
| H | 0,13  | 0,31  | 0,00  | 0,30     | 0,20   | 0,12     | 0,09  | 1,00       | 0,47  | 0,48  | 0,08  | 0,33  | 0,23  | 0,70 |
| I | 0,12  | 0,30  | 0,05  | 0,41     | 0,36   | -0,03    | 0,17  | 0,47       | 1,00  | 0,70  | 0,06  | 0,26  | 0,28  | 0,70 |
| J | 0,08  | 0,24  | 0,09  | 0,31     | 0,33   | 0,17     | 0,22  | 0,48       | 0,70  | 1,00  | -0,01 | 0,28  | 0,38  | 0,71 |
| K | -0,14 | -0,13 | -0,11 | 0,14     | 0,12   | 0,28     | 0,13  | 0,08       | 0,06  | -0,01 | 1,00  | 0,35  | -0,05 | 0,30 |
| L | -0,13 | -0,02 | 0,14  | 0,28     | 0,34   | 0,23     | 0,10  | 0,33       | 0,26  | 0,28  | 0,35  | 1,00  | 0,16  | 0,64 |
| M | 0,15  | 0,37  | 0,01  | 0,22     | 0,28   | 0,27     | -0,01 | 0,23       | 0,28  | 0,38  | -0,05 | 0,16  | 1,00  | 0,56 |
| N | 0,09  | 0,32  | 0,23  | 0,50     | 0,46   | 0,34     | 0,33  | 0,70       | 0,70  | 0,71  | 0,30  | 0,64  | 0,56  | 1,00 |
|   |       |       |       | stronger | strong | moderate | weak  | negligible |       |       |       |       |       |      |

|   |                                                                                                              |                |                                   |
|---|--------------------------------------------------------------------------------------------------------------|----------------|-----------------------------------|
| A | AGE                                                                                                          | 0.7 to 1       | Very strong positive relationship |
| B | AGE OF DIAGNOSIS                                                                                             | 0.4 to 0.69    | Strong positive relationship      |
| C | HOW OFTEN DO YOU ORDER IN FAST FOOD                                                                          | 0.3 to 0.39    | Moderate positive relationship    |
| D | DO YOU FEEL YOU EXPERIENCE A SENSE OF LOSS OF CONTROL OVER YOUR EATING                                       | 0.2 to 0.29    | Weak positive relationship        |
| E | DO YOU FIND THAT YOU EAT MORE FOOD WHEN YOU ARE BORED                                                        | 0.01 to 0.19   | Negligible relationship           |
| F | DO YOU STRUGGLE TO REGULATE YOURSELF IN GENERAL                                                              | 0              | No correlation                    |
| G | DO YOU FIND YOURSELF ORDERING IN FOOD SO YOU DON'T HAVE TO CLEAN                                             | -0.01 to -0.19 | Negligible relationship           |
| H | HOW OFTEN DO YOU PROCRASTINATE DOING TASKS                                                                   | -0.2 to -0.29  | Weak negative relationship        |
| I | HOW OFTEN DO YOU FIND YOURSELF EATING FOOD AS A DISTRACTION FROM INTENSE EMOTIONS                            | -0.3 to -0.39  | Moderate negative relationship    |
| J | DO YOU EAT EXCESSIVELY WHEN YOU ARE EXPERIENCING A STRONG NEGATIVE EMOTION                                   | -0.4 to -0.69  | Strong negative relationship      |
| K | HOW FREQUENTLY DO YOU FIND THAT YOU HAVE NOT EATEN FOR MOST OF THE DAY SO YOU EAT A LARGE MEAL TO COMPENSATE | -0.7 to -1     | Very strong negative relationship |
| L | HOW OFTEN DO YOU FEEL UNCOMFORTABLY FULL AFTER YOU FINISH A MEAL                                             |                |                                   |
| M | HOW ASHAMED ARE YOU LIKELY TO FEEL AFTER EATING A LARGE AMOUNT OF FOOD                                       |                |                                   |
| N | GRAND TOTAL                                                                                                  |                |                                   |

### Insights of findings

A self-report survey was distributed to a convenient population wherein participants who had been formally diagnosed with ADHD were asked to answer questions related to impulsivity, self-regulation, and their general relationship with food. The self-report survey consisted of 19 questions, of which two were discarded due to their irrelevance, which was only realised post-collection. The remaining 17 questions were grouped into four subsections: demographic information, impulsivity, self-regulation, and general. The first section was used to ascertain the characteristics of the sample. The additional three sections consisted of questions related to the participants relationship with eating in terms of the two executive functions and their relationship with food. The answers received from the participants were scored appropriately - the maximum score for the survey was 53. The research proposal identified three hypotheses to be investigated. Hypothesis 1 posited that participants would experience difficulty with regards to their impulsivity, Hypothesis 2 stated that participants would frequently find themselves unable to regulate their behaviour during times of increased emotionality, and finally Hypothesis 3 stated that participants would exhibit symptoms related to binge-eating disorder. Each of these hypotheses were investigated through data analysis.

### Characteristics of the Sample

Despite initial estimations for the sample size, the number of participants who met the required criteria was 55. All participants were between the ages of 18 and 55, and were native or fluent English speakers, had been formally diagnosed with ADHD by a medical professional, and had not been medicated for the disorder for the past three months. Participants who regularly take stimulant medication were excluded, this as stimulant medication such as methylphenidate commonly results in side-effects such as loss of appetite which may have affected the data collected. Stimulant medications are often prescribed to patients with BED, due to this side effect and the reduction of impulsivity (Davis et al., 2016).

In addition to questions related to the sampling criteria, demographic information was collected. The demographic information included the age, gender, ADHD-subtype, and age of diagnosis of each participant. The sample was overwhelmingly skewed in terms of participant gender, with 81.8% of participants identifying as female. The majority of participants were between the ages of 20 and

35 years old. The mean age of participants was 28 years old, with the youngest participant being 18 and the oldest participant being 47. However, the mean age of male participants was 26 years old. The mean was therefore greatly affected by the age of female participants. Only two participants identified as non-binary, this was not statistically significant.

Participants were additionally asked at what age they received their ADHD diagnosis. Age of diagnosis was included as early-diagnosis was theorised to be a confounding variable. This due to the increased possibility that these participants may have learnt appropriate coping skills early in life, which may reduce the occurrence of symptoms of BED. Upon analysis of results it was found that there were no statistically significant differences between participants who were diagnosed with ADHD before age seven and those who were diagnosed after the age of eighteen. When differentiating in terms of gender, 62.5% of male participants were diagnosed before the age of 18 – this is consistent with previous research which found that female patients were less likely to be diagnosed with ADHD during childhood due to their internalisation of symptoms (Gershon, 2002; as cited in Zalsman & Shilton, 2016). Analysis found that 65.5% of participants reported that they were only professionally diagnosed with ADHD after the age of eighteen. It can be inferred that the increase in adult diagnosis, noted in this study and others, may be linked to the improvements in diagnostic criteria for ADHD in the revision of the (DSM) in 2013.

With the revision of the diagnostic criteria for ADHD in the DSM-5 (2013) came the inclusion of ADHD subtypes. These subtypes were identified as ADHD-predominantly inattentive, ADHD-predominantly hyperactive/impulsive, and ADHD-combined presentation. Zalsman & Shilton (2016) found that ADHD-predominantly inattentive was most prevalent amongst adult patients, the results of the present study were similarly in line with this. The present study was reasonably balanced in terms of subtype. While ADHD-predominantly inattentive was most frequently reported by participants, the combined presentation was only 3.6% less frequently reported. Additionally, 21.8% of respondents were unsure of their ADHD-subtype. As participants were distributed fairly evenly in this regard, the ADHD subtype has a minimal effect on the results of the study. While this even distribution improves the sample's generalisability, the results of this study may not be generalisable to the

target population due to the ratio of male to female participants and due to the limitations in terms of sampling and sample size.

## Discussion

### *Hypothesis 1: Impulsivity*

As mentioned previously, the self-report survey that was issued to the accessible population was divided into subsections. Each of these subsections aimed to collect data which could be used to accept or deny the study's hypotheses.

Subsection 2 focussed on the measurement of participant's impulsivity. This subsection consisted of four closed-ended questions, which were scored appropriately. For example, when asked how often they were unable to resist impulsive behaviours or reactions, participants were given three choices: always, sometimes, or never. An answer of 'always' gained a score of 3, while 'never' was scored as 1. A participant could score a maximum of 15 in this subsection. Impulsivity was considered to be increased in participants who scored 10 or more out of this 15. When analysed descriptively, the average total score in subsection 2 was 9.9 – however the mean was affected by an outlier who scored only 7 for this section. It may be more pertinent to note that the mode was 11, this perhaps being a more beneficial measure of the average scores. As impulsivity is one of the core criteria for the diagnosis of ADHD it was expected that participants would score high on those questions which were focussed on impulsivity not related to food however, to investigate hypothesis 1 questions were formulated that were aimed at measuring food-related impulsivity (Giel et al., 2017). For example: do you find that you eat more food or snack excessively when you are bored? This question was rated (3) Always, (2) Sometimes, and (1) Never. The mean score for this specific question was 2.7 – this indicates that a randomly chosen participant from this sample is most likely to 'always eat excessively when bored' therefore indicating impulsive binge-eating behaviours.

Question 2.1 of the self-report survey queried how frequently the participant was unable to resist their impulsive behaviours or reactions, this question was not included in the correlational studies as all participants answered "sometimes". The remaining three questions were included in the correlational calculations. Participants who noted that they experienced a sense of loss of control over their eating, were strongly positively correlated with an increased 'grand total' and were

more likely to answer that they frequently ate food as a distraction from their emotions. Additionally, those participants who noted that they ate food out of boredom were more likely to score highly in their 'grand total', this shown by a positive correlation of 0,46. These correlations show that while participants scored that they "sometimes" struggled to control their impulsive behaviours, they also noted that they were more likely to act impulsively with regards to food.

From the analysed data, impulsive behaviours relating to food and eating were frequently reported. From this, hypothesis 1 can be accepted – individuals with ADHD are more likely to struggle with their control of food-related impulses. A hallmark of this seems to be linked to a sense of loss of control – which additionally links impulsive behaviours to binge-eating disorder.

#### *Hypothesis 2: Self-regulation*

Hypothesis 2 posited that participants would frequently find it difficult to self-regulate, especially in times of increased emotionality. This hypothesis was drawn from a number of previous studies which had linked BED to emotional eating and the subjective feeling of loss of control (Goldschmidt et al., 2008; as cited in Kittel et al., 2017). Kittel et al. (2017) theorised that this sense of loss of control implied that self-regulatory difficulties were a hallmark for the development of BED. Note that self-regulation includes emotional regulation and cognitive flexibility (Kenny et al., 2017). Kenny et al. (2017) additionally stated that "difficulties in ER were positively associated with binge frequency" (p.1303).

Subsection 3 of the self-report survey was therefore focussed on the participants ability to regulate their emotions, whether they frequently found that they used eating as a self-soothing mechanism when experiencing intense emotions, and finally whether participants were able to regulate themselves by maintaining a routine. Participants could score a maximum of 24 and a minimum of 6 points in this subsection - participants were considered to have poor self-regulation strategies if they scored 15 or more. 63.6% of respondents scored above 15 in this subsection. While the mean score for this subsection of the survey was 16.5, this score was once again influenced by an outlier who scored only 7 points. To provide a more reliable average, the mode was calculated, and the most frequent score was 20. This indicates that participants were more likely to struggle with self-regulation overall.

When asked how often participants ate to distract themselves from intense emotions – the majority noted that they did so at least once a week.

From the correlational study, participants who noted that they ate food as a distraction from intense emotions were very likely to note that they also ate excessively when they were experiencing a strong negative emotion – these two questions has a very strong positive relationship with a correlation coefficient of 0.70. Notably, the question asking participants to rate how frequently they found that they had not eaten for most of the day (and then ate a large meal to compensate) did not return a strong correlational relationship, instead this question either had a negligible or weak relationship with most of the other questions. This indicates that participants were not likely to eat excessively without additional emotional stimulus. It has been concluded that participants were more likely to experience difficulty in terms of self-regulation in times of intense emotionality, thus allowing for the acceptance of hypothesis 2. This finding is in line with previous research, for example: Svedlund et al. (2017) found that poor self-regulation was frequently referenced as a central issue in both ADHD and BED.

#### *Hypothesis 3: Symptoms of BED*

Subsection 4 focussed on measuring participants' experiences when eating food in general. This section consisted of two Likert ratings, participants were asked to rate from 1 to 7, (a) how likely they were to feel uncomfortably full after finishing a meal, and (b) how ashamed they were likely to feel after eating a large amount of food. The maximum score for this section was 14, and participants were considered to have a negative relationship with food if they scored 10 or more points. 63.6% of participants scored 10 or more points in this subsection, indicating that this sample was more likely to have a perceive their relationship with food as negative. The results collected from this subsection aid in the acceptance of hypothesis 3, that patients with ADHD were likely to exhibit BED symptoms. Symptoms of BED include feelings of regret, guilt, or shame after a binge-eating episode, and a binge-eating episode would leave the patient feeling uncomfortably full (APA, 2013; Ballarotto et al., 2017). As the majority of participants noted the presence of the above, hypothesis 3 can be partially accepted.

In order to fully accept hypothesis 3, the results self-report survey as a whole must be analysed. The maximum score of each subsection was added to a total maximum score of 53. The notable scores for each subsection was then added to a total score of 35. Participants who scored above 35 for the entire survey were considered to exhibit behaviours which are related to binge-eating disorder. As noted previously, these BED related behaviours included impulsivity with regard to food-related behaviours, poor self-regulation in terms of meal related routine and eating as an emotional outlet, and experiencing discomfort following meals. 36 participants out of 55 scored above 35. The average score for this sample was calculated to be a mean of 37.1 – thus, implying that participants were more likely to exhibit BED related behaviours and feelings.

Notably in the correlational study, the grand total was recurrently positively correlated with other questions. The grand total exhibited a very strong positive relationship with participants who rated that they procrastinate doing tasks (0.70), they ate food as a distraction from intense emotions (0.70), and those who noted that they often ate excessively when they were experiencing a strong negative emotion (0.71). Additionally, a strong positive relationship was found between the grand total and a participant who experienced a sense of loss of control over their eating (0.50), who ate more food when they were bored (0.46), and who felt ashamed or uncomfortably full following a meal (0.56). As BED symptoms include a sense of loss of control, feelings of shame after a binge-eating episode, and a binge-eating episode leaves the patient feeling uncomfortably full, (APA, 2013; Ballarotto et al., 2017), it can be inferred that majority of the participants who noted behaviours similar to these also scored highly on their overall rating on the self-report study. Participants with ADHD are thus more likely to exhibit symptoms of BED – hypothesis three can therefore be accepted.

#### *Discussion of findings*

Participants within the present study were found to struggle with impulsivity (general and food related), self-regulation (especially in times of increased emotionality) and were likely to display behaviours that are in line with a BED diagnosis. It can be concluded that these participants, who have been formally diagnosed with ADHD, did exhibit binge-eating symptoms that are characterised by deficits in the executive functions of impulse control and self-regulation.

## Conclusion

Through a comprehensive review of literature on the subject, a self-report survey was designed which aimed to measure impulsivity, self-regulation, and binge-eating type habits in participants diagnosed with attention-deficit hyperactivity disorder. The survey proved internally reliable through the calculation of Cronbach's Alpha which gave an acceptable result of 0,85. The self-report survey was distributed to the accessible population and the responses were analysed statistically. This statistical analysis consisted of descriptive analysis and the calculation of Pearson's correlation coefficient for each question which provided nominal results. The statistical analysis allowed for the acceptance of the three hypotheses, the sum of which resulted in an answer to the research question. Is there a comorbid relationship between binge-eating disorder and ADHD characterised by deficits in impulse control and self-regulation? Hypothesis 1 proved a relationship between ADHD and poor impulse control, hypothesis 2 proved a relationship between ADHD and poor self-regulation, and hypothesis 3 proved that participants frequently displayed symptoms of binge-eating disorder. As such this study has inferred that there is a comorbid relationship between ADHD and BED which is characterised by deficits in executive functioning. This research serves as a foundation for future investigation into the topic, it is suggested that future research make use of random sampling and a larger sample size in order to increase generalisability. This study has not provided generalisable results due to the characteristics of the sample, and as such it is suggested that this study be used as a pre-test of the measure for future research.

## Ethical Considerations

In line with the ethical guidelines provided by the IIE, the present research study is not a high-risk study and did not include any subjects, topic, or participants that were deemed to be high risk. In order to avoid sensitive topics and vulnerable communities the study purposefully avoided communities which were considered at-risk according to IIE ethical regulations. The survey therefore was not administered to any participants who were within mental or prison institutions, were under the age of 18, or who did not understand the purpose of the study. Contact details were provided for the research team should participants have had any concerns or questions regarding the study. Prior to participation, the participants were asked to

read and acknowledge an information sheet and consent form<sup>8</sup>. This consent form and information sheet; detailed the study, where data is stored, contact details of those involved in the study, details of ethical clearance, confidentiality of provided data, and the acknowledgement that the participant could withdraw their participation and data at any stage of the survey without any implications. The psychological and physiological safety of participants is of utmost importance – it was noted that individuals diagnosed with ADHD are unlikely to experience harm from studies wherein their symptoms are investigated. This assumption is of course not universal, and could depend on the individual participant and their comorbid conditions – participants were therefore encouraged to withdraw from the survey if they felt any discomfort and were advised to visit a medical professional should they note any lasting psychological symptoms stemming from the research. All participation was voluntary, the participant was free to withdraw from the study at any point should they wish to, and participation was entirely anonymous.

## Limitations

It is important to note that the study took place during a tense sociological environment. Due to the covid-19 pandemic that has affected every country around the globe, there may have been unseen consequences stemming from this that may have affected the results of the study. Intervening variables, such as stay-at-home orders and loss of income, may affect the participants mental-state and could have influenced their access to medication and therapeutic interventions, emotional regulation, and the prevalence of binge-eating. Binge-eating episodes may have increased due to heightened emotionality and the lack of physical outlet, but these episodes may have also decreased due to lack of economic stability or access to 'quick' food.

Regardless of the current global pandemic, the study does present several other limitations. In terms of researcher bias, it is noted that the researcher themselves has been formally diagnosed with BED and adult-ADHD – this may lead to bias when interpreting results or the formation of methodology. In order to mitigate this limitation, the researcher has made the research supervisor aware of this

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<sup>8</sup> See Annexure D

diagnosis, and the researcher has taken care not to place subjective opinion into the results of the study.

Additionally, the study is limited by the use of non-random sampling methods. Convenience sampling does not lend itself to generalisable data due to the greater opportunity for researcher bias (du Plooy-Cilliers, Davis, & Bezuidenhout, 2014). However, it should be noted that convenience sampling was the best fit for a study of this nature due to the large target population and the inability to access a sample from this population in a random manner. The use of convenience sampling was noted to be biased towards the social context of the researcher – the implementation of online-convenience sampling cannot accurately generalise results to the greater population as not all of the target population has access or is aware of these online platforms. In order to mitigate this limitation, the study implemented strict sampling-criteria, thus limiting the accessible population and further narrowing the target population to those participants who had been diagnosed with ADHD, were not currently on medication, and who were between the ages of 18 and 55. The results are not generalisable to the greater ADHD-population but instead are better generalised to unmedicated adults with a formal ADHD diagnosis.

### Heuristic Value

The present study, while limited, has proved to be a successful foundation for additional research on the topic. The present study would prove useful as a pre-test of the measurement instrument, which may be reviewed and used in future research.

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## Annexure A: Models of Executive Function

**Table 1**  
Executive Function Models with Components

| <i>Model</i>              | <i>f</i> | <i>Components</i>                                                                                                                                                                                   |
|---------------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Researcher-developed      | 43       | See Table S1                                                                                                                                                                                        |
| Miyake et al. (2000)      | 35       | Shifting<br>Inhibition<br>Updating                                                                                                                                                                  |
| No model                  | 10       |                                                                                                                                                                                                     |
| Diamond (2006)            | 6        | Inhibitory control<br>Working memory<br>Cognitive flexibility                                                                                                                                       |
| "Hot" and "Cool"          | 5        | Cognitive control/<br>regulation/problem<br>solving<br>Emotional control/<br>regulation/problem<br>solving<br>Working memory<br>Attentional control<br>Planning<br>Monitoring<br>Inhibitory control |
| Unitary model             | 4        |                                                                                                                                                                                                     |
| Baddeley and Hitch (1974) | 3        | Central executive                                                                                                                                                                                   |

(Beggatta and Alexander, 2016)

## Annexure B: Google Form

### Information Sheet

# ADHD, Impulsivity, Emotional Regulation, & Eating

My name is Thalia Frost and I am a student at The IIE Varsity College in Cape Town, South Africa.

I am currently conducting research under the supervision of Dr Richard Vergunst about the relationship between attention deficit hyperactivity disorder (ADHD) and binge-eating disorder (BED). I hope that this research will enhance our understanding of the comorbidity of these two disorders and will lead to the further creation of therapeutic interventions.

I would like to invite you to participate in my study.

In order to explain to you what your participation in my study will involve, I have formulated questions that I will try to fully answer so that you can make an informed decision about whether or not to participate.

If you have any additional questions that you feel are not addressed or explained in this information sheet, please do not hesitate to ask me for more information.

Once you have read and understood all the information contained in this sheet and are willing to participate, please complete the consent form attached.

What will I be doing if I participate in your study?

I would like to invite you to participate in this research because you are part of the population for which this research study is intended to benefit. If you decide to participate in this research, I would like you to complete the survey attached to the best of your ability.

You can decide whether or not to participate in this research. If you decide to participate, you can choose to withdraw at any time (this can be done by simply exiting the survey before clicking submit) and your withdrawal will have no adverse consequences.

Are there any risks involved in participating in this study?

Whether or not you decide to participate in this research, there will be no negative impact on you. There are no direct risks or benefits to you if you participate in this study. If you find at any stage that you are not comfortable with the line of questioning, you may withdraw your participation. These questions are not intended to be harmful to you or others – if you find you experience any adverse effects please contact a medical professional.

Do I have to participate in the study?

Your inclusion in this study is completely voluntary;  
If you do not wish to participate in this study, you have every right not to do so;  
Even if you agree to participate in this study, you may withdraw at any time without having to provide an explanation for your decision.

Will my identity be protected?

The nature of this survey is entirely anonymous. No personal details will be recorded without your consent, and your name/contact details will not be collected at any stage. Information that may possibly be used to identify you will be kept strictly confidential and will not be used in any way which could lead to you to be personally identified. All collected data will only be accessible by myself and my supervisor.

What will happen to the information that participants provide?

Once surveys have been completed, I will analyse and summarise the information to be included in my research report, which is a requirement to complete the Research Module. A summary of my research will be posted on relevant sites and you may contact me should you wish to read the results of the study in depth.

What happens if I have more questions about the study?

Please feel free to contact me or my supervisor should you have any questions or concerns about this research, or if there is anything you need to know before you decide whether or not to participate.

You should not agree to participate unless you are completely comfortable with the procedures followed.

\* Required

I have read and understand the above information provided to me about the present study \*

☐ Yes, I agree

Next

## Consent Form

# ADHD, Impulsivity, Emotional Regulation, & Eating

\* Required

I agree to participate in the research conducted by Thalia Frost about ADHD and binge-eating disorder. This research has been explained to me and I understand what participation in this research will involve.

I understand that:

- ☐ I agree to participate in a survey for this research.
- ☐ My confidentiality will be ensured. My name and personal details will not be recorded.
- ☐ My participation in this research is voluntary and I have the right to withdraw from the research at any time. There will be no repercussions should I choose to withdraw from the research. I understand that should I wish to withdraw, I need only leave the survey page.
- ☐ I may choose not to answer any of the questions that are asked during the survey.

By clicking accept I acknowledge that I have read and understand the above and would like to continue to the survey.

By clicking accept I acknowledge that I have read and understand the above and would like to continue with the survey \*

☐ Accept

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## Demographic Questions

### ADHD, Impulsivity, Emotional Regulation, & Eating

\* Required

#### Demographic Information

Age \*

Your answer

What gender do you identify as? \*

☐ Female

☐ Male

☐ Non-Binary

☐ Other: \_\_\_\_\_

Have you been formally diagnosed with ADHD by a medical professional? \*

☐ Yes

☐ No

What subtype of ADHD have you been diagnosed with? \*

☐ ADHD - Predominantly inattentive

☐ ADHD - Predominantly hyperactive/impulsive

☐ ADHD - Combined presentation

☐ I am not sure

When were you formally diagnosed with ADHD? \*

- ☐ 0 - 7 years old
- ☐ 8 - 12 years old
- ☐ 13 -18 years old
- ☐ 18+ years old

Have you taken any stimulant medication to treat ADHD in the past three months? (Ritalin/Vyvanse/Concerta etc.)

- ☐ Yes
- ☐ No

Have you ever been diagnosed with an eating disorder by a medical professional? \*

- ☐ Yes
- ☐ No

If yes, what disorder were you diagnosed with?

- ☐ Binge-eating Disorder
- ☐ Anorexia Nervosa
- ☐ Bulimia Nervosa
- ☐ Eating disorder non-specified (EDNOS)
- ☐ Prefer not to say
- ☐ No disorder diagnosed

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## Impulse control questions

### ADHD, Impulsivity, Emotional Regulation, & Eating

\* Required

#### Impulse Control & Eating

This section aims to evaluate the relationship you may have with eating in terms of impulsivity or impulse control

How often are you unable to resist impulsive behaviours or reactions? \*

- ☐ Always
- ☐ Sometimes
- ☐ Never

Do you find yourself ordering in food so that you do not have to tidy up or spend time cooking? \*

- ☐ Always
- ☐ Sometimes
- ☐ Never

How often do you eat food as a way to procrastinate doing tasks? \*

- ☐ Never
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Daily
- ☐ Other: \_\_\_\_\_

How often do you order in take away or eat fast food? \*

- ☐ Once a month
- ☐ Once every two weeks
- ☐ Once a week
- ☐ Three or more times a week
- ☐ Never

Do you feel you experience a sense of loss of control over your eating? (For example; you eat too much food and can't seem to stop yourself) \*

- ☐ Yes, always
- ☐ Yes, sometimes
- ☐ No, never
- ☐ I don't understand
- ☐ Other: \_\_\_\_\_

How frequently do you find that you have not eaten for most of the day and find yourself eating a large meal to compensate? \*

- ☐ Every day
- ☐ Every other day
- ☐ Once a week
- ☐ Never
- ☐ Other: \_\_\_\_\_

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## Self-Regulation Questions

### ADHD, Impulsivity, Emotional Regulation, & Eating

\* Required

#### Self-Regulation & Eating

This section aims to understand your relationship with food and your ability to self-regulate

Do you struggle to regulate yourself in general? (You may not be able to set working routines, accomplish tasks timeously etc.) \*

- ☐ Always
- ☐ Sometimes
- ☐ Never

How often do you find yourself eating food as a distraction from intense emotions? (For example: anger, excitement, etc.) \*

- ☐ Never
- ☐ Once a month
- ☐ Once a week
- ☐ Every day
- ☐ Every time I experience an intense emotion

Do you eat excessively when you are experiencing particularly strong negative emotions? (anger, sadness, etc.)

- ☐ Never
- ☐ Sometimes
- ☐ Always

Do you find that you eat more food or snack excessively when you are bored? \*

- ☐ Always
- ☐ Sometimes
- ☐ Never

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Never submit passwords through Google Forms.

## General Questions

# ADHD, Impulsivity, Emotional Regulation, & Eating

\* Required

## General

These questions are general questions used to ascertain your relationship with food

How often do you feel uncomfortably full after you finish a meal? \*

- |       |                       |                       |                       |                       |                       |                       |                       |            |
|-------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|------------|
|       | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |            |
| Never | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Every time |

How ashamed are you likely to feel after eating a large amount of food? \*

- |                      |                       |                       |                       |                       |                       |                       |                       |                   |
|----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------------|
|                      | 1                     | 2                     | 3                     | 4                     | 5                     | 6                     | 7                     |                   |
| I never feel ashamed | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Extremely ashamed |

Which of the adjectives below would you use to describe your relationship with food? (please do not use the 'other' option unless you feel that absolutely none of the below apply to you) \*

- ☐ Healthy
- ☐ Stable
- ☐ Controlled
- ☐ Out of control
- ☐ Harmful
- ☐ Regular/Normal
- ☐ Impulsive
- ☐ Emotional
- ☐ Other: \_\_\_\_\_

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Thank you

## ADHD, Impulsivity, Emotional Regulation, & Eating

Thank you!

Thank you so much for your participation!

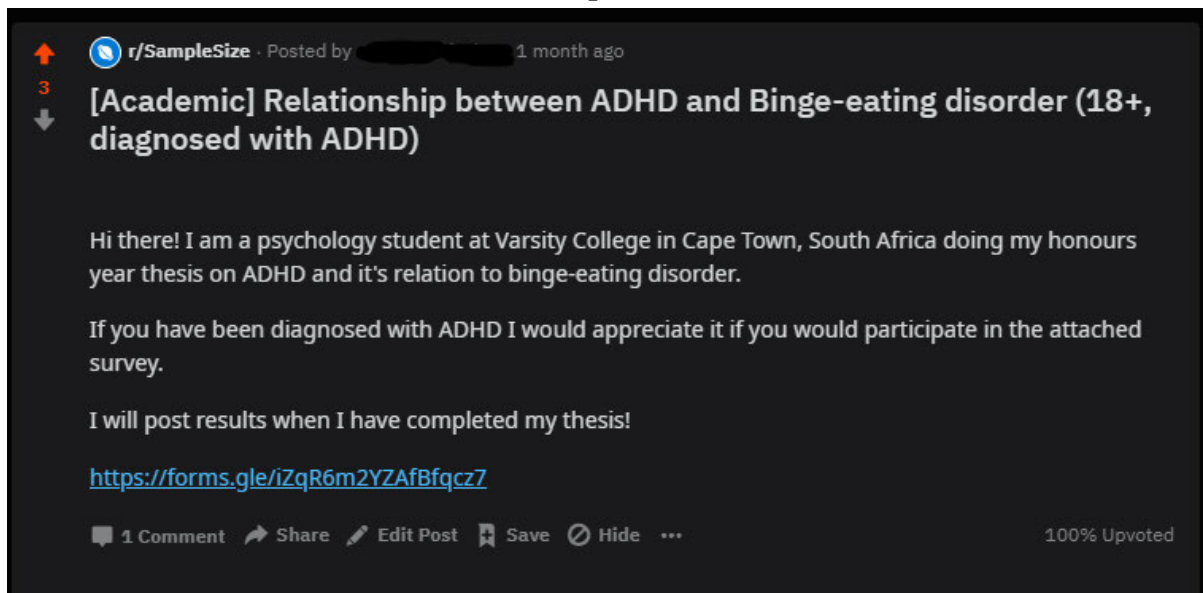
For more information feel free to email me: [thaliabimota@gmail.com](mailto:thaliabimota@gmail.com)

I will post results of the study on completion of my thesis.

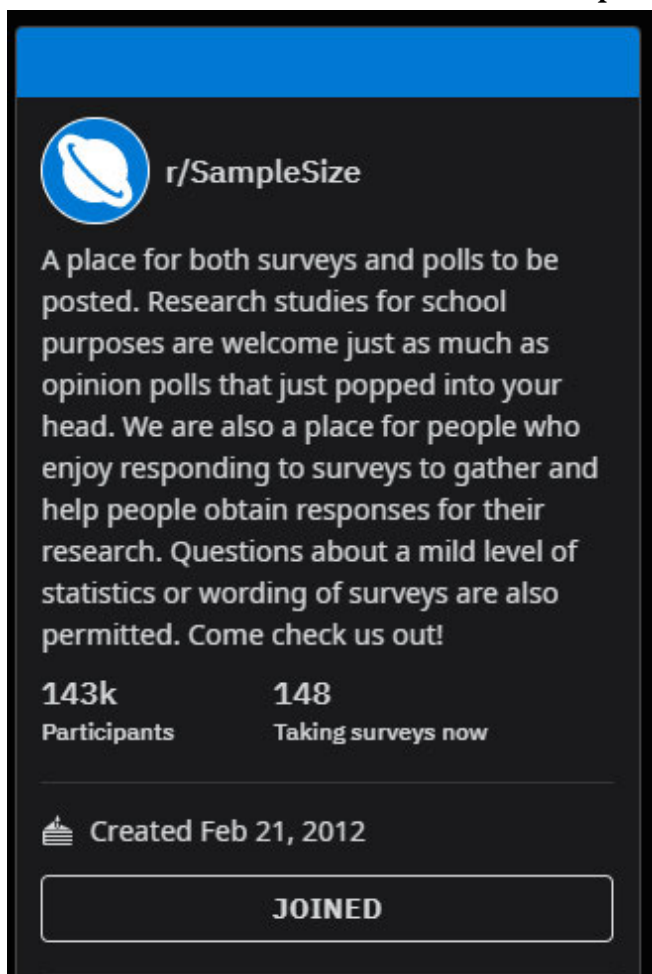
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## Annexure C: Example of data collection



## Annexure D: Example of Online Forum



## Annexure E: Numerical scoring of items

| <b>Consent Form/Information Sheet</b>                                                                                                        |                                                                                                                                      |                                                                                                                          |                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| I acknowledge that I have read and agree to the above information: Y/N                                                                       |                                                                                                                                      |                                                                                                                          |                                                                               |
| <b>Demographic/Sample Data Collection</b>                                                                                                    |                                                                                                                                      |                                                                                                                          |                                                                               |
| Age:                                                                                                                                         | (18 – 55)                                                                                                                            | Gender                                                                                                                   | (1M/2F/3NB)                                                                   |
| ADHD Diagnosis                                                                                                                               | (1) ADHD-Predominantly Inattentive<br>(2) ADHD-Predominantly Hyperactive-Impulsive<br>(3) ADHD-Combined presentation<br>(4) Not sure | When were you formally diagnosed with ADHD?                                                                              | (1) 0 – 7 y/o<br>(2) 7 – 12 y/o<br>(3) 13 – 18 y/o<br>(4) 18 + y/o            |
| Have you taken any stimulant medication to treat your ADHD in the past three months?                                                         |                                                                                                                                      |                                                                                                                          | Y1/N2                                                                         |
| Have you ever been diagnosed with binge-eating disorder by a medical professional?                                                           |                                                                                                                                      |                                                                                                                          | Y1/N2                                                                         |
| If yes to above, what diagnoses did you receive?                                                                                             |                                                                                                                                      |                                                                                                                          | (1) EDNOS<br>(2) BED<br>(3) AN<br>(4) BN<br>(5) None<br>(6) Prefer not to say |
| <b>Impulse Control &amp; Eating</b>                                                                                                          |                                                                                                                                      |                                                                                                                          |                                                                               |
| How often are you unable to resist impulsive behaviours or reactions?                                                                        |                                                                                                                                      | - Sometimes (1)<br>- Always (2)<br>- Never (3)                                                                           |                                                                               |
| How often do you order in take away or eat fast food?                                                                                        |                                                                                                                                      | - Once a month (1)<br>- Once every two weeks (2)<br>- Once a week (3)<br>- Three or more times a week (4)<br>- Never (5) |                                                                               |
| Do you feel you experience a sense of loss of control over your eating? (For example; you eat too much food and can't seem to stop yourself) |                                                                                                                                      | - Yes, always (1)<br>- Yes, sometimes (2)<br>- No, never (3)<br>- I don't understand (4)                                 |                                                                               |
| Do you find that you eat more food or snack excessively when you are bored?                                                                  |                                                                                                                                      | - Always (1)<br>- Sometimes (2)<br>- Never (3)                                                                           |                                                                               |
| <b>Self-Regulation &amp; Eating</b>                                                                                                          |                                                                                                                                      |                                                                                                                          |                                                                               |
| Do you struggle to regulate yourself in general? (You may not be able to set working routines, accomplish tasks timeously etc.)              |                                                                                                                                      | - Always (1)<br>- Sometimes (2)<br>- Never (3)                                                                           |                                                                               |
| Do you find yourself ordering in food so that you do not have to tidy up or spend time cooking?                                              |                                                                                                                                      | - Always (1)<br>- Sometimes (2)<br>- Never (3)                                                                           |                                                                               |

|                                                                                                                             |                                                                                                                                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| How often do you eat food as a way to procrastinate doing tasks?                                                            | <ul style="list-style-type: none"> <li>- Never (1)</li> <li>- Once a month (2)</li> <li>- More than once a month (3)</li> <li>- Once a week (4)</li> <li>- More than once a week (5)</li> <li>- Everyday (6)</li> </ul>                              |
| How often do you find yourself eating food as a distraction from intense emotions?                                          | <ul style="list-style-type: none"> <li>- Never (1)</li> <li>- Once a month (2)</li> <li>- Once a week (3)</li> <li>- Every day (4)</li> <li>- Every time I experience an intense emotion (5)</li> </ul>                                              |
| Do you eat excessively when you are feeling particularly strong negative emotions, such as sadness or anger?                | <ul style="list-style-type: none"> <li>- Never (1)</li> <li>- Sometimes (2)</li> <li>- Always (3)</li> </ul>                                                                                                                                         |
| How frequently do you find that you have not eaten for most of the day and find yourself eating a large meal to compensate? | <ul style="list-style-type: none"> <li>- Every day (1)</li> <li>- Every other day (2)</li> <li>- Once a week (3)</li> <li>- Never (4)</li> </ul>                                                                                                     |
| <b>General</b>                                                                                                              |                                                                                                                                                                                                                                                      |
| How likely are you to feel uncomfortably full after you finish a meal?                                                      | <ul style="list-style-type: none"> <li>- Always</li> <li>- Sometimes</li> <li>- Never</li> </ul>                                                                                                                                                     |
| How often do you feel uncomfortably full after you finish a meal?                                                           | 1 – 7 likert                                                                                                                                                                                                                                         |
| How ashamed are you likely to feel after eating a large amount of food?                                                     | 1 – 7 likert                                                                                                                                                                                                                                         |
| Which of these would you use to describe your relationship with food?                                                       | <ul style="list-style-type: none"> <li>- Out of control (1)</li> <li>- Impulsive (2)</li> <li>- Stable (3)</li> <li>- Controlled (4)</li> <li>- Harmful (5)</li> <li>- Emotional (6)</li> <li>- Healthy (7)</li> <li>- Regular/Normal (8)</li> </ul> |

\*Items highlighted in red were removed from final data analysis

## Annexure F: Ethical clearance letter



30 June 2020

Student name: Thalia Frost

Student number: 15002798

Campus: Varsity College Cape Town

Re: Approval of Honours in Psychology Proposal and Ethics Clearance

### HONOURS ETHICAL CLEARANCE LETTER

Your research proposal and the ethical implications of your proposed research topic were reviewed by your supervisor and the campus research panel, a subcommittee of The Independent Institute of Education's Research and Postgraduate Studies Committee.

Your research proposal posed no significant ethical concerns and your supporting documents and instruments are in order to proceed. We hereby provide you with permission to proceed with your research.

In the event of you deciding to change your research methodology in any way, kindly consult your supervisor to ensure all ethical considerations are adhered to and pose no risk to any participant or party involved. A revised ethical clearance letter will be issued.

We wish you all the best with your research!

## Annexure G: Research Report Summary Table

A study on the relationship between ADHD and binge eating disorder in unmedicated adults, as moderated by impulsivity and poor self-regulation.

| Research Purpose                                                                                                                         | Research Question                                                                                                                                                                                                                                                        | Research Rationale                                                                                                                            | Seminal Authors/ Sources                                                                                                                                                                                 | Literature Review & Conceptual Framework                                                                                                                                                                                            | Approach                                                                                                                                                                        | Data Collection Method                                                             | Ethics                                                                                                                                                       | Key Findings                                                                                                                                                                                            | Recommendations                                                                                                                                       |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Study aimed to investigate whether participants with ADHD displayed BED symptoms, in order to assess the comorbidity of the disorders.   | Is there a relationship between BED and ADHD characterised by deficits in impulse control and self-regulation?                                                                                                                                                           | BED & adult-ADHD are new inclusions in the DSM5, thus they are understudied despite their prevalence. Study aimed to fill this knowledge gap. | Barker, RA Baggetta & Alexander Ballarotto et al. Bleck et al. Cortese et al. Giel et al. Jacob et al. Kenny et al. Kittel et al. Manasse et al. Savci et al. Stulz et al. Svedlund et al. Zelazo et al. | <u>Theme 1:</u><br>ADHD<br>1.1. History<br>1.2. Presentation<br>1.3. EF Deficits<br><br><u>Theme 2:</u><br>BED<br>2.1. History<br>2.2. EF Deficits<br><br><u>Theme 3:</u><br>ADHD & BED<br>3.1. Impulsivity<br>3.2. Self-Regulation | Quantitative<br><br><u>Population</u><br><u>Target:</u> Adults with ADHD<br><br><u>Accessible:</u><br>English speaking adults aged 18 – 55 + online access + active media users | Self-report survey distributed online through Reddit and Facebook community forums | Study has avoided vulnerable communities as outlined by the IIE<br><br>Informed consent form required by all participants after a detailed information sheet | Participants with ADHD are likely to act impulsively with regards to food, struggle to self-regulate during times of increased emotionality, and frequently perceive a negative relationship with food. | It is my recommendation that BED be considered highly comorbid with ADHD, and that the present study's self-report survey be used in future research. |
| Research Problem                                                                                                                         | Hypotheses                                                                                                                                                                                                                                                               | Key Concepts                                                                                                                                  | Key Theories                                                                                                                                                                                             | Paradigm                                                                                                                                                                                                                            | Sampling                                                                                                                                                                        | Data Analysis Method                                                               | Limitations                                                                                                                                                  | Key Contribution                                                                                                                                                                                        |                                                                                                                                                       |
| As ADHD and BED are contemporary diagnoses, there is a gap in knowledge surrounding their comorbidity. Study aims to attend to this gap. | H1: participants experience difficulty with regards to their impulsivity<br>H2: participants frequently find themselves unable to regulate their behaviour during times of increased emotionality<br>H3: participants exhibit symptoms related to binge-eating disorder. | ADHD – BED – executive function – executive dysfunction – impulsivity – self regulation – emotional regulation                                | Executive Functioning, specifically elements of impulsivity and self-regulation.                                                                                                                         | <u>Paradigm:</u><br>Positivist<br><br><u>Epistemology:</u><br>Objective knowledge<br><br><u>Ontology:</u><br>Realism<br><br><u>Axiology:</u><br>Value and bias-free                                                                 | Non-probability<br><br>Convenience sampling<br><br>55/150 participants                                                                                                          | Statistical analysis<br><br>Descriptive<br><br>Using JASP and Excel                | COVID-19 impact on participants<br><br>Researcher diagnosed with BED and ADHD<br><br>Non-random sampling methods                                             | Due to the sample size and sampling method, the study contributes to the body of knowledge as a pre-test for future investigations.                                                                     |                                                                                                                                                       |